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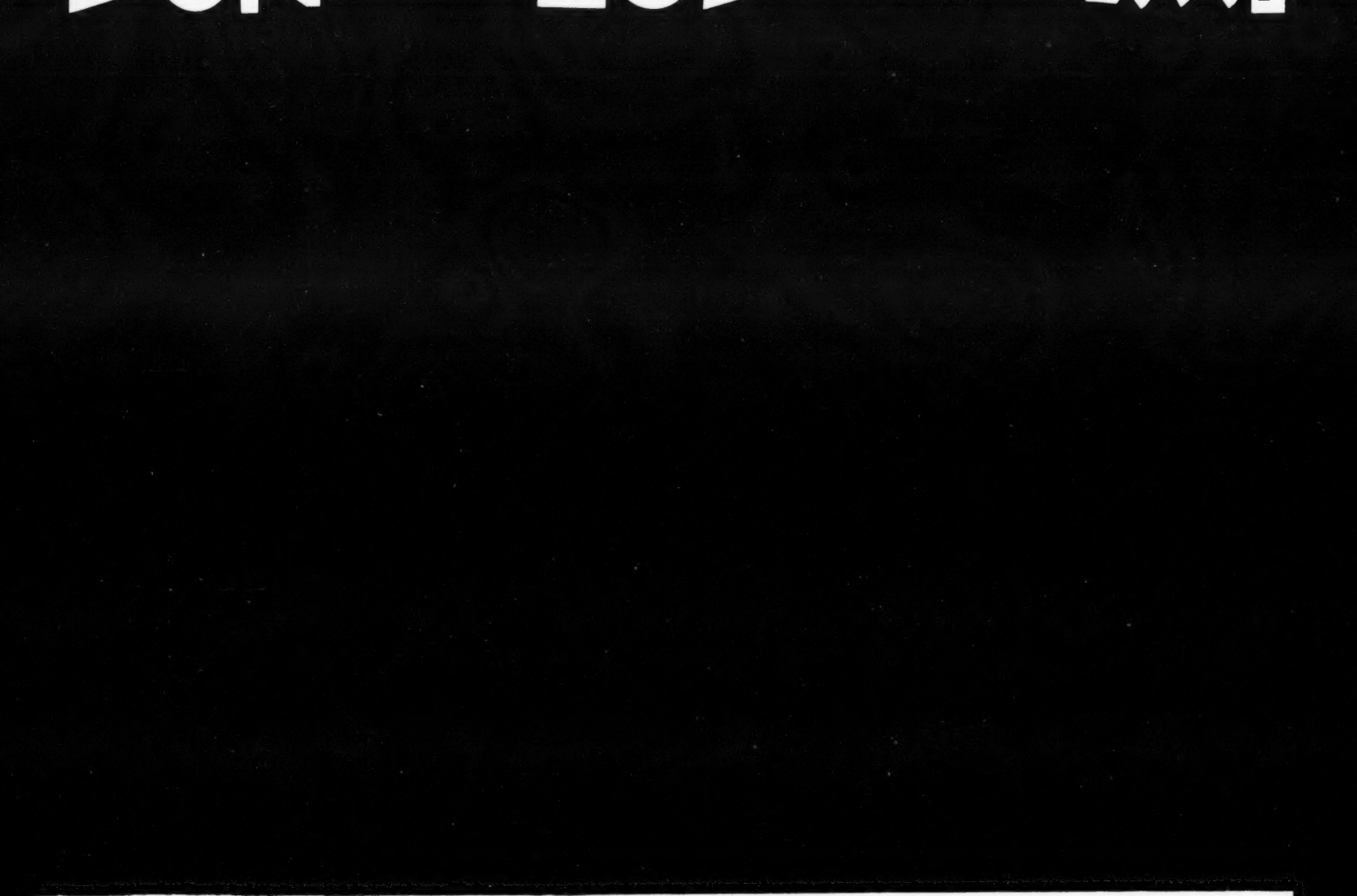

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PRODUCTIVITY AND SOCIAL ORGANIZATION IN AN INDIAN WEAVING SHED

An Examination of some Aspects of the Socio-Technical System of an Experimental Automatic Loom Shed

A. K. RICE

The tendency to treat the technological and social organizations of an industrial unit as separate systems has sometimes led to difficulty when technological change has been introduced without adequate appreciation of its social repercussions. In their account of the Hawthorne Studies (3), Roethlisberger and Dickson described an industrial organization as a social system and drew attention to the interdependence of the technological and human organizations. In the human organization they included the formal and informal structures of groups. Trist and Bamforth in a study of coalmining (4) showed that the introduction of the three shift longwall cycle into British coalmining resulted in the breakdown of an established social system and to the formation of maladaptive mechanisms as defences against the social and psychological consequences of the technological organization. Rice and Trist in investigating change in labour turnover (2) used a method of analysis which suggested that an understanding of the whole system—the socio-technical system, containing both technical and social dimensions—was necessary to explain both kind and direction of change in labour turnover when either technological or social change occurred.[1]

This paper describes a preliminary analysis of the socio-technical system of an experimental automatic loom shed, weaving cotton cloth, on the basis of which the methods of working were reorganized and an increase in productivity achieved. The analysis was made during recent work by the

1. E. L. Trist of the Tavistock Institute, who collaborated with the author in the writing of this paper first used the concept of *socio-technical* system when studying the socio-psychological and technical problems of the introduction of increased mechanization in coal-mining. The term has since been extended to designate a general field of study concerned with the interrelations of the technical and socio-psychological organizations of production systems.

Tavistock Institute in the Ahmedabad Manufacturing and Calico Printing Company Limited in Ahmedabad, India. The company, known more familiarly as the "Calico Mills", manufactures finished cloth from raw cotton and employs approximately eight thousand workers. The author visited the mills in the capacity of professional consultant. The purpose of his visit, which was exploratory, was to allow both the Company and the Institute to discover whether it was possible to establish a collaborative relationship in which the Institute could make a contribution to the solution of the general social and production problems of the mills. The analysis was made in collaboration with a development group in which the author worked with the Chairman, the Mill Manager, and Works Manager of the Company. (The Works Manager was the direct executive subordinate of the Mill Manager, who reported directly to the Chairman. The Works Manager also acted, however, as Technical Staff Officer to the Chairman.) The members of this group and the author collaborated closely, working as a group, in pairs or singly as the situation demanded, until each was satisfied, from his own point of view, of the validity of the analysis. They reported as a group to the other members of senior management at all stages. The decision to initiate the reorganization was taken by the Chairman at a meeting which was attended by all Senior Managers. At that meeting the Weaving Master of the mill concerned was called in. He listened with evident enthusiasm to the proposals and began at once to produce from his own experience arguments in their favour. The Works Manager, as the senior executive responsible for the experimental loom shed, then discussed the proposals with the Top Supervisor of the shed. Thereafter the supervisors and workers in the loom shed took over the proposals as their own; and within a few hours, to the surprise of management, the workers had organized their own working groups. The Chairman, the Mill Manager, the Works Manager, and the author did not attend any of the discussions with supervisors or workers, nor did they visit the loom shed again until the reorganization had been implemented. The author returned to London on the seventh day of the experimental period and the results reported in this paper have been sent to him by the Works Manager. The paper has, however, been discussed in detail with the Chairman of the Company on a recent visit to England. His help with the paper and his permission to publish it are gratefully acknowledged.[2]

The paper is divided into three parts. First, there is a brief description of the loom shed before reorganization; second, this organization is analysed and the reorganization is described; and finally, the results of the reorganization are reported.

2. Members of the Ahmedabad Manufacturing and Calico Printing Company: Development Group —Gautam Sarabhai, Chairman of the Company, J. A. Gandhi, Mill and Sales Manager, and J. C. Thaker, Works Manager; other members of the Senior Management concerned—S. A. Kher, Finance and Purchasing Manager, and W. H. Date, Personnel Manager; Members of Mill and Shed Management—T. M. Desai, Weaving Master, C. P. Caprihan, Top Supervisor, and M. M. Bhatt, S. R. Rajguru and B. B. Dave, Work Supervisors.

I. THE EXPERIMENTAL AUTOMATIC LOOM SHED

The Activities of the Loom Shed

Automatic looms had been introduced into one of the mills of the Ahmedabad Manufacturing and Calico Printing Company in June 1952. By March 1953 an experimental shed containing 224 looms had been set up. It was designed eventually to hold 304 looms but, at the time of reorganization, a part of the shed was still under construction.

The operations of automatic weaving are carried out by bobbins containing *weft* yarn (threads across the length of cloth) and *beams* containing *warp* yarn (threads along the length of cloth). An automatic loom is prepared for weaving by *loading*. A beam is *gated* into brackets at the back of a loom and each warp thread is passed through the eye of a *heald*, then through a *reed* or comb, to keep it in place and is finally connected to a roller on the front of the loom which takes the woven cloth. A bobbin containing weft yarn is placed in a *shuttle* from which it is automatically ejected when it is empty or the weft thread breaks. Empty bobbins are automatically replaced by full bobbins stored in a *battery*. When the loom is weaving the shuttle is knocked backwards and forwards through a *shed* formed by the separation of the warp threads by the rise of some healds and the fall of others. As the shuttle travels through the shed it leaves behind it a weft thread which is wound from the bobbin within the shuttle. Each weft thread so inserted is banged into place by the reed. The weaving ceases when the warp yarn on the beam has all been converted into cloth on the roller. The loom is then *unloaded*, the finished cloth is taken from the loom (this may occur at intervals during weaving by cutting off the finished cloth) and the empty beam is removed. During weaving, stops of short duration occur whenever a warp thread breaks. A loom is restarted when the broken ends have been joined together (knotted). The looms are fitted with mechanical stops which halt the loom automatically whenever a warp thread breaks.

The activities of a single loom are, therefore, cyclic—load, weave, unload. But since weaving time (including stops for yarn breaks) always greatly exceeds loading and unloading time, the total activities of a loom shed containing a number of looms are continuous, only a small proportion of the looms being stopped for loading and unloading at any one time. During stops for the loading and unloading of looms, general loom maintenance, automatic device maintenance, tuning, and oiling activities are carried out, and all accumulated fluff is removed from under the loom.

The length of yarn which can be wound on a beam or on a bobbin depends upon the size of the beam or bobbin and upon the fineness of the yarn (the *count*—the finer the yarn, the higher the count). The kind of cloth woven (*sort*) depends upon the count of the yarn, and upon the number of threads to the inch in both warp and weft. The rate of weaving depends, therefore, upon the speed and continuity of loom run and upon sort.

TABLE 1 *OCCUPATIONAL ROLES, TASKS, SOCIAL ORGANIZATION AND RATES OF PAY OF SUPERVISORS AND WORKERS ON ONE SHIFT OF EXPERIMENTAL AUTOMATIC LOOM SHED*

Occupational Role	*Number per Shift*	*Task*	*Social Organization*	*Position on Scale Based on Rate of Pay**
Top Supervisor	1	Is responsible for the quality of production of cloth by the shed. Co-ordinates work of two Shifts.	Responsible to Weaving Master of Mill; has as direct subordinates Work Supervisor, Erection Supervisor, and Humidification Fitter.	8·0
Erection Supervisor	1	A specialist temporarily provided by the loom manufacturers during installation of looms.	Responsible to Top Supervisor; no subordinates.	8·0
Work Supervisor	1	Co-ordinates and controls all workers in loom shed except the humidification fitter; allocates work and manages relationships between different kinds of workers.	Responsible to Top Supervisor. All workers other than humidification fitter comprise his command.	3·5
Jobber	2	Maintains looms and adjusts them when running; prepares loom for weaving after beam is "gated"; adjusts healds, threads reed, and tunes loom.	Responsible to Work Supervisor; forms a pair relationship with Assistant Jobber; makes relationships with weavers, oilers, sweepers and gaters, over whom he exercises directive authority.	2·3
Feeler-Motion Maintenance Fitter	1	Maintains automatic device which starts mechanical process of ejecting empty bobbins and replacing them with full.	Responsible to Work Supervisor, works by himself, informed of need for services by Supervisor, Jobber or Weaver.	2·2
Weaver	8	Joins broken ends of yarn by knotting; restarts loom after stops. Responsible for 24 or 32 looms depending on the degree of training received.† Depends upon services of all other workers, in particular upon gater, jobber, smash-hand, feeler-motion maintenance fitter and battery filler.	Responsible directly to Work Supervisor, and to jobber, and exercises some directive authority over smash-hands who rank as assistant weavers.	1·6–2·0
Humidification Fitter	1	Maintains humidification plant and keeps constant check on humidity.	Responsible to Top Supervisor. Works by himself.	1·8

* The positions on the scale are determined by taking the wage of the lowest paid workers as 1 and showing other rates of pay in proportion. Actual rates are not given to avoid complications of comparison with British and American standards of living. The pay rates are related to status.

† The standard number of looms per weaver had started at 12, had been increased successively to 18, 24 and 32, and the provisional target was 64.

Occupational Role	*Number per Shift*	*Task*	*Social Organization*	*Position on Scale Based on Rate of Pay*
Assistant Jobber	2	Assists jobber on complex tasks and performs simple jobber's tasks under supervision.	Responsible to jobber with whom he makes a pair relationship.	1·4–1·8
Gater	2	Removes empty beam and places new beam with healds in brackets at back of loom. (Warp threads are already drawn through healds.) May assist jobber in preparing loom for weaving.	Responsible to Work Supervisor; works partly by himself and partly with jobber; informed of need for services by Supervisor, jobber or weaver.	1·6
Battery Filler	5	Keeps batteries charged with filled bobbins.	Responsible to Work Supervisor; works by himself but can be called upon by the weaver.	1·2
Oiler	1	Oils looms.	Responsible to Work Supervisor but instructed to oil loom by jobber.	1·1
Smash-hand	3	Joins broken ends of yarn after a smash, i.e., when a large number of threads break at once through some major fault.	Responsible to Work Supervisor and to weaver by whom he is informed of need for services (in training as a weaver).	1·0
Cloth Carrier	1	Removes woven cloth from looms and transports to Inspection department.	Responsible to Work Supervisor. Works by himself but has to approach weaver to stop loom so that he can carry out his task.	1·0
Bobbin Carrier	2	Transports full bobbins from Spinning department to loom shed. Removes empty bobbins ejected by automatic device and returns them to Spinning department.	Responsible to Work Supervisor. Works by himself.	1·0
Sweeper	1	Removes dirt and fluff from shed.	Responsible to Work Supervisor. Works by himself except when called to clean under loom by jobber during loading.	1·0
Total	32‡			

‡ The total number of workers in the shed was considered to be adequate ultimately for 240 looms instead of the 224 then in the shed.

Under the climatic conditions in Ahmedabad relative humidity in the loom shed has to be artificially maintained at 80–85 per cent to enable yarn to stand up to the strain put on it in the weaving process. For this purpose a plant is installed which humidifies the whole shed.

Two eight-hour shifts were worked, the day shift from 7.00 a.m. to 3.30 p.m. with a half-hour break from 11.00 a.m. to 11.30 a.m., and the night shift from 3.30 p.m. to midnight with a half-hour break from 7.30 p.m. to 8.00 p.m.

Productivity is measured by two figures—efficiency and damage. Efficiency is the number of *picks* (weft threads) inserted in any shift, expressed as a percentage of the number of picks which would have been inserted had the loom run continuously for the whole shift—no allowance is made for loading, unloading or for any other stops. Damage is the percentage of cloth not accepted as of standard quality by the inspectors and viewers after weaving. The higher the efficiency and the lower the damage, the greater the productivity.

The Occupational Roles and Tasks

Current British and American practice had been followed in the organization of the shed. The total task of weaving had been broken down into component operations, and each component was performed by different workers. The number of workers allocated to the various tasks had been based upon British, American, and Japanese[3] standards modified by time studies of work under Indian conditions and based upon yarn breakage rates existing in the mill at the time of installation. The experimental shed started working when twelve looms had been installed. Neither management nor workers had had experience of modern working methods with automatic looms. During the first eight months looms were brought into production as they were erected and workers trained to use them. By March 1953 relatively stable conditions had been established, and further loom erection had been halted pending the completion of the building. The numbers of workers on a shift, their tasks, and their positions on a scale based on differential rates of pay during March 1953 are shown in *Table 1*.

A first examination of *Table 1* shows that, although all the tasks of the shed were interdependent, only the jobbers and assistant jobbers had any form of stable work group structure and that the other workers formed an aggregate of individuals some of whom were virtually independent of each other. The jobbers had some authority over most other workers and weavers had some authority over smash-hands, but the lines of authority were confused and undefined. For example, the oiler could be directed by a jobber, but the relative authority of the two jobbers was not established; in the same

3. The looms in the shed are of Japanese manufacture and figures of worker allocation of similar installations in Japan were supplied by the manufacturers.

way the smash-hands could be given orders by a weaver, but the order in which the eight weavers could demand their services was not defined.

The Work Organization

Because the production process of a loom shed, in contrast to that of a single loom, is continuous rather than cyclic all activities in the shed were directed to maintaining the *steady state* of multiple loom weaving. Production in the shed, therefore, depended upon the simultaneous carrying out of all the activities of the shed. The activities were carried out by workers who performed tasks and took occupational roles. The tasks performed by the

TABLE 2 *THE NUMBER OF LOOMS PER WORKER AND THE NUMBER OF WORKERS IN EACH OCCUPATIONAL ROLE IN THE EXPERIMENTAL AUTOMATIC LOOM SHED*

Activity	*Task*	*Occupational Role*	*Number of Looms per Worker*	*Number of Workers*
Weaving	Knotting broken yarn	Weaver	24–32	8
	Battery filling	Battery Filler	40–50	5
	Removing empty bobbins	Bobbin Carrier	224	1
	Knotting broken yarn	Smash-hand	60–80	3
Loading and Unloading	Replacing empty beams	Gater	112	2
	Removing woven cloth	Cloth carrier	112	2
Loom Maintenance	Fitting and tuning	Jobber	112	2
	Fitting	Assistant Jobber	112	2
	Specialized fitting	Feeler-Motion Fitter	224	1
	Oiling	Oiler	224	1
Cleaning	Sweeping and cleaning	Sweeper	224	1
Humidifying	Specialized fitting	Humidification Fitter	224	1
Totals	12	12	—	29

workers related their occupational roles to the activities of the shed. Because the activities of the shed had been broken down into their component tasks and the number of workers required to perform the tasks had been determined by work studies of the separate components, workers in different occupational roles worked on different numbers of looms. For example, weavers operated twenty-four or thirty-two looms depending upon their skill, while battery fillers charged the batteries of from forty to fifty looms and smash-hands served on average seventy-five looms. This method of determining the number of workers required to carry out a total production

process is the normal production engineering corollary of job-breakdown and work study. Katz and Kahn have included it as a major factor in their concept of the Machine Theory of Organization (1). The analysis of the loom shed showing the number of workers and the number of looms per worker related to activities, tasks and occupational roles is shown in *Table 2*.

In *Table 2* it can be seen that each task was allocated to one occupational role, and that the twelve tasks were, therefore, performed by twenty-nine

TABLE 3 *DIFFERENTIATION OF EXPERIMENTAL AUTOMATIC LOOM SHED INTO LOOM GROUPS*

Kind of Loom Group	*Number of Loom Groups*	*Number of Tasks in Each Loom Group*	*Number of Workers in Kind of Loom Group*	*Occupational Roles*
I (24–32)	8	1	8	Weaver
II (40–50)	5	1	5	Battery Filler
III (60–80)	3	1	3	Smash-hand
IV (112)	2	4	8	Gater Cloth Carrier Jobber Assistant Jobber
V (224)	1	5	5	Bobbin Carrier Feeler-Motion Fitter Oiler Sweeper Humidification Fitter
Totals	19	12	29	

workers who, between them, took twelve occupational roles. It may also be seen that the looms in the shed were divided into five different kinds of loom-group which varied as to the number of looms, the number of tasks performed, and the number of workers engaged in each group. This analysis is shown in *Table 3*, from which it can be seen that the twelve tasks performed by twenty-nine workers were performed in a total of nineteen overlapping loom groups of five kinds. The differentiation of the looms into loom groups is also shown in *Figure 1*.

Management Hierarchy of the Loom Shed

One consequence of the different kinds of loom groups and of the allocation of one component task to one occupational role was that the workers

FIGURE 1 ORGANIZATION OF LOOM SHED IN OVERLAPPING LOOM GROUPS

I. Eight Groups of **24-32**:

1 Weaver	*1 Weaver*	*1 Weaver*	*1 Weaver*	*1 Weaver*	*1 Weaver*	*1 Weaver*	*1 Weaver*
24-32 LOOMS	**24-32** LOOMS	**24-32** LOOMS	**24-32** LOOMS	**24-32** LOOMS	**24-32** LOOMS	**24-32** LOOMS	**24-32** LOOMS

II. Five Groups of **40-50**:

1 Battery Filler	*1 Battery Filler*	*1 Battery Filler*	*1 Battery Filler*	*1 Battery Filler*
40-50 LOOMS	**40-50** LOOMS	**40-50** LOOMS	**40-50** LOOMS	**40-50** LOOMS

III. Three Groups of **60-80**:

1 Smash Hand	*1 Smash Hand*	*1 Smash Hand*
60-80 LOOMS	**60-80** LOOMS	**60-80** LOOMS

IV. Two Groups of **112**:

1 Jobber *1* Assistant Jobber *1* Gater *1* Cloth Carrier **112** LOOMS	*1* Jobber *1* Assistant Jobber *1* Gater *1* Cloth Carrier **112** LOOMS

V. One Group of **224**:

1 Bobbin Carrier
1 Feeler Motion Fitter
1 Oiler
1 Humidification Fitter
1 Sweeper
224 LOOMS

could not conveniently be grouped for supervision. Thus, in spite of the directive responsibility of the jobbers for all other workers and of the weavers for some, the Work Supervisor was directly responsible for twenty-six different individuals. A chart of the management organization is shown in simplified form in *Figure 2* (it was not possible to represent all lines of communication).

The overall picture of loom shed organization is a confused pattern of relationships among an aggregate of individuals for whom no stable internal group structure could be discerned. This picture may be both compared and contrasted with that found by Trist and Bamforth in the longwall system of coalmining (4). The effect of job-breakdown and task allocation led there, especially on the filling shift, to a similar aggregate of individuals with no discernible stable internal group structure; but the sequential nature of the process led to splitting and isolation, and the segregation of those engaged on component tasks of the total process both between and within shifts. In the experimental automatic loom shed the continuous nature of the process and the simultaneous performance of all component tasks led to confusion.

Change of Sort

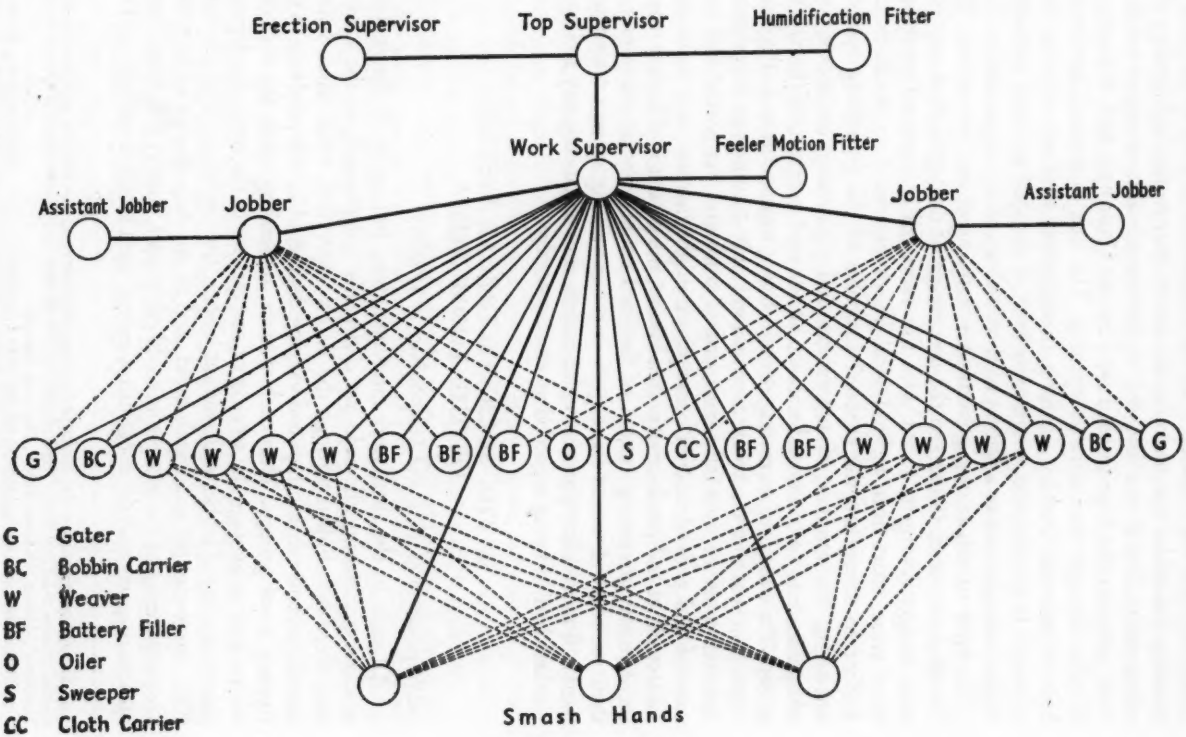
A change of sort—kind of cloth woven—may change the work-load of some of the workers. Thus a change of sort involving a change to a higher reed (greater number of threads per inch in the warp) may require an increase in the number of weavers, because the greater number of threads may cause more frequent breaks, but a change involving a yarn of finer count may require a decrease in the number of battery fillers, gaters, and bobbin carriers, because more yarn could be wound on bobbins and beams. Without necessarily requiring an alteration in the total number of workers, a change of sort involved, therefore, either a change in individual work loads or change in the kinds of workers employed. Each change altered the relationships between interdependent tasks and restructured some of the loom groups. Any change of sort was, therefore, likely to add to the confusion of task and worker relationships.

The Government of the Shed

The Work Supervisor had so much to do in the handling of work allocations and of worker relationships that the Top Supervisor had to assist him by dealing directly with jobbers and other workers. Indeed, had not the Top Supervisor so helped the Work Supervisor, it is difficult to see how he could usefully have filled his time. In the same way the jobbers' technological tasks were so many and their supervising responsibility so undefined that the Work Supervisor had to assist them by giving direct orders to their nominal subordinates.

This breakdown of the hierarchical structure placed a high premium on the quality of the relationships between the supervisors and between the Work

FIGURE 2 MANAGEMENT HIERARCHY OF THE EXPERIMENTAL AUTOMATIC LOOM SHED



Supervisor and the workers. That the breakdown had led to no overt relationship difficulties was undoubtedly due in part to the high quality of the relationships, but it was also due to the considerable attention which had been given to the experimental shed by the Chairman, Mill Manager, and Works Manager ever since its opening. The lack of internal structure had been counterbalanced by a strong management structure external to the workers. In practice the *governing system*[4] of the shed included members of higher management in addition to those shown on the organization chart.

In spite of this strong governing system, however, the current figures for efficiency were lower and the percentage of damaged cloth was higher than budgeted targets. Faced with this short-fall in expected productivity there were, apart from technological improvements, two possibilities: still further to strengthen the external structure of the governing system by increasing the number of supervisors and tightening inspection, or by reorganization, to create and stabilize an internal structure of the working-group. The danger of increasing the number of supervisors and of tightening inspection was that the workers would not only continue to experience the discomfort of the internally unstructured confusion but would feel further coerced and policed, and in consequence might increase their resistance to greater effort and productivity. In addition, the presence of higher management in the governing system of the shed could only be temporary, and their withdrawal would leave gaps in the governing system which would need still more supervisors as replacements, thus enhancing any feelings the workers had of being regarded as untrustworthy.

II. THE SOCIO-TECHNICAL SYSTEM OF THE LOOM SHED[5]

Interdependence of Task and Independence of Workers

All tasks in the shed were interdependent, but many of the individual workers performing the tasks were virtually independent, in the sense that they were only linked through the Work Supervisor, while those who had interdependent relationships had varying degrees of interdependence in overlapping loom groups. Thus each weaver, depending upon the sort on his looms, had on average the services of one quarter of the time of a dependent pair consisting of jobber and assistant jobber; five-eighths of that of a battery filler; three-eighths of a smash-hand, and so on. Any change of sort altered the proportions of the services he could command. Battery fillers each served, on average, one and three-eighths weavers; each smash-hand two and two-

4. The system, external to the production system which services, co-ordinates, and controls the production system. Rice and Trist, "Institutional and Sub-Institutional Determinants of Change in Labour Turnover", *Human Relations*, Vol. V, No. 4, p. 348 (2).

5. The principles used in making this analysis were formulated by E. L. Trist in studying the development in continuous mining in No. 1 Area, East Midlands Division of the National Coal Board, especially the type of organization that seems to be emerging in relation to the machine faces.

thirds weavers. With some sorts the time of a particular battery filler might be completely filled in serving the looms of two weavers and there was then opportunity for the two weavers and their battery filler to build interdependent relationships consistent with the interdependence of their tasks, but this was not a common pattern.

Generally, it may be said that the area of the shed and the number of workers were both too large and task relationships too confused for there to be much opportunity to build stable, cohesive relationships between the members of the total work group, and the confused loom groups precluded the formation of small, internally structured and internally led work-groups consistent with task relatedness.

Iob Breakdown, Multiple Grades and Worker Mobility

Job breakdown and consequent specialization had reduced the quality and range of skills required for performance of tasks in the loom shed. A weaver no longer had to service his looms, tune them, refill shuttles, or stop the loom to prevent damage. Indeed, the loom itself had become the weaver and all the workers in the loom shed now serviced this mechanical weaver. In spite of the persistence of the title of weaver for one of the occupational roles the weaver's task may be more accurately described as *loom-end-knotting*. The similarity of his task to that of a *piecer* in ring spinning will be recognized by all who are familiar with the textile industry.

In general, specialization of task had restricted the possibilities of task or role rotation. Because of low labour turnover only the prospect of completion of the shed and the installation of more looms, an isolated event, held out any real hope of promotion or transfer. Even such an event only offered the opportunity of transfer from one specialized task to another.

Mobility was further restricted by the many different status grades and, since the status grades were allied to rates of pay, almost any exchange of tasks would have involved a change of pay—a change only easy to accomplish in one direction. In short, the workers were chained to their roles and tasks.

Small Work Group Organization

Six assumptions were made about work-group organization, that:

(*a*) *when individual tasks are interdependent the relationships between those performing the tasks will have important effects on productivity;*

(*b*) *groups of workers engaged in the same loom group are more likely to form internally structured stable and cohesive group relationships than those in overlapping groups;*

(*c*) *interchangeability of tasks (role rotation) gives greater freedom of movement to workers;*

(*d*) *the coincidence of obvious physical and loom-group boundaries enables a working group to realize itself and identify itself with its "territory";*

(*e*) *the fewer differences there are in work-group status (and pay) consistent with offering opportunities for promotion, the more likely is the internal structure of a group to stabilize itself and the more likely are its members to accept internal leadership;*

(*f*) *when individual members of small work-groups become disaffected to the extent that they can no longer fit into their work-group, they need to be able to move to other small work-groups engaged on similar tasks if group stability is to be maintained.*

None of the conditions made in these assumptions were satisfied by the existing socio-technical system. The tasks of the loom shed were therefore re-examined. The smash-hands were already accepted as weavers in training; and the weaver depended to a considerable extent on the efficiency with which the battery filler performed his task. The battery fillers in their turn, had aspirations to become weavers. Bobbin carriers fetched all bobbins from the Spinning department for the battery fillers. Assistant jobbers were already members of a pair, and gaters sometimes assisted jobbers to get looms running after a stop to replace an empty beam. The feeler-motion maintenance fitter was responsible for a specialist part of general loom maintenance. The oiler was under the nominal control of both jobbers, and although the sweeper and the cloth carrier each had his special task and were not considered interchangeable, they and the oiler were all graded as unskilled.

Short and Long-Loom Stops as a Basis for Analysis

Cloth is only woven when the loom is running; all tasks in the shed are, therefore, directed to keeping the loom weaving. Loom stops are of two kinds: *short stops* caused by simple yarn breaks (half minute to one minute); and *long stops* for gating (one to one and a half hours), meal breaks (half an hour) and intervals between the second and first shifts (seven hours). During actual shift hours workers could be divided into those whose tasks were directed to keeping the looms running through short stops and those whose tasks were to get the looms weaving again after a long stop. Thus weavers, battery fillers, smash-hands, and bobbin carriers were concerned with the weaving loom, while gaters and cloth carriers were concerned when the loom was stopped for loading new beams at the back or for removing finished cloth from the front. At the same time, the jobber, assistant jobber, feeler-motion fitter and oiler had to use the opportunity of a long-stop to obtain access to the loom for maintenance work. Even the sweeper had to use that time as his only opportunity to get under the loom to remove accumulated fluff. Only the humidification fitter was not concerned directly with looms and was, therefore, ignored in the subsequent analysis. The temporal analysis of the occupational roles and tasks in terms of short and long stops is shown in *Table 4*.

The re-examination of shed tasks and the temporal analysis of occupa-

TABLE 4 *TEMPORAL ANALYSIS OF OCCUPATIONAL ROLES AND TASKS*

Occupational Roles	*Tasks Connected With*			
	Short Stops	*Long Stops*		*Departmental Duties*
	Weaving	*Loading-Unloading*	*Loom Maintenance*	
Weavers	×			
Battery Fillers	×			
Smash-hands	×			
Bobbin Carrier	×			
Gaters		×		
Cloth Carrier		×		
Jobbers			×	
Assistant Jobbers			×	
Feeler-Motion Fitter			×	
Oiler			×	
Sweeper			(×)	×
Humidification Fitter				×

tional roles and tasks suggested that two sub-groupings were possible—a short-stop sub-group and a long-stop sub-group which would include those concerned with loading and unloading and with loom maintenance.

Variation in Numbers Required with Change of Sort

Change of sort demanded change in the number of weavers, battery fillers, and gaters, less change in the number of cloth carriers and bobbin carriers, and virtually no change in the number of other workers. To examine the limits of the changes required, the theoretical number of looms which could be attended by weavers, battery fillers, and gaters was calculated for each sort likely to be woven in any loom shed in the mill. These theoretical numbers are shown in *Table 5*.

The results of *Table 5* were then converted to show the number of workers who would theoretically be required to work 960 looms for all varieties of sort. (The figure 960 was chosen arbitrarily to give a large enough number to avoid too much approximation.) These results are shown in *Table 6*, in which it will be seen that although there are considerable variations in the number of weavers, battery fillers, and gaters over the whole range they can be grouped into three main sorts in which comparatively little variation occurs in the total number of weavers and battery fillers or in the number of gaters. These main sorts correspond to the coarse, medium, and fine counts.

Variation in the numbers of cloth carriers and bobbin carriers with change

TABLE 5 *THEORETICAL NUMBER OF LOOMS PER WORKER BY SORTS*

Sort Number	*Short-Stops per Loom Hour**	*Looms per*		
		Weaver	*Battery Filler*	*Gater*
1	1·4	38	28	80
2	1·4	38	33	116
3	1·2	42	50	96
4	1·4	38	66	114
5	1·4	38	66	114
6	1·6	35	69	114
7	1·6	35	69	80
8	1·6	35	69	98
9	2·0	32	84	80
10	2·0	32	84	115
11	1·6	35	110	300
12	1·8	33	110	360
13	1·8	33	120	300
14	1·8	33	120	360
15	1·8	33	138	360
16	2·0	32	138	360

TABLE 6 *NUMBER OF VARIABLE WORKERS FOR 960 LOOMS*

Sort		*Weavers*	*Battery Fillers*	*Total Weavers and Battery Fillers*	*Gaters*
Coarse	1	26	34	60	12
	2	26	29	55	9
Medium	3	23	19	42	10
	4	26	15	41	9
	5	26	15	41	9
	6	27	14	41	9
	7	27	14	41	12
	8	27	14	41	10
	9	30	12	42	12
	10	30	12	42	9
Fine	11	27	9	36	3
	12	29	9	38	3
	13	29	8	37	3
	14	29	8	37	3
	15	29	7	36	3
	16	30	7	37	3

* The figures for short stops per loom hour in this column were based on existing performances; in addition to the figures shown in this and subsequent tables, other figures based on the carrying out of technical improvements which would reduce the rate of yarn breakage were also calculated.

of sort was found to be too small to merit consideration. It appeared, therefore, that, provided weavers and battery fillers could be regarded as partly interchangeable tasks, two kinds of workers would be required whose numbers varied with change of sort. The figures are summarized in *Table 7*,

TABLE 7 *VARYING NUMBER OF WORKERS REQUIRED FOR 960 LOOMS*

Occupational Roles	*Numbers Required for Each Main Sort*		
	Coarse	*Medium*	*Fine*
Weavers Battery Fillers	60	42	38
Gaters	12	12	3
Totals	72	54	41

in which the greatest numbers in the columns of total Weavers and Battery Fillers and of Gaters for each of the three main sorts was taken.

The numbers of other workers required for 960 looms based on the numbers in the shed are shown in *Table 8*.

TABLE 8 *NUMBER OF OTHER WORKERS REQUIRED FOR 960 LOOMS*

Occupational Roles	*Number Required For All Sorts*
Jobbers	8
Assistant Jobbers	8
Feeler-Motion Mechanics	4
Oilers	4
Sweepers	4
Bobbin Carriers	4
Cloth Carriers	8
Smash-hands	12
Total	52

Theoretical Work Group Organization

The results of the analyses shown in *Tables 4*, *7*, and *8* were then combined with the results of the re-examination of related occupational roles. The combined result is shown in *Table 9*.

Inspection of the loom shed showed that the looms were installed in rows of sixteen and that wide gangways separated off two blocks of sixty-four.

That is to say that a block of sixty-four looms was an easily recognizable territory separated from other looms by wide gangways and pillars. The outline plan of the shed is given in *Figure 3*. Further constructional work and the installation of more looms would turn the two blocks of twenty-four into two more blocks of sixty-four.

TABLE 9 *THEORETICAL NUMBERS OF WORKERS REQUIRED FOR 960 LOOMS*

Sub-Group	*Occupational Roles*	*Numbers Required for Each Main Sort*		
		Coarse	*Medium*	*Fine*
Short Stop	Weavers Battery Fillers	60	42	38
	Smash-hands	12	12	12
	Bobbin Carriers	4	4	4
	Totals	76	58	54
Long Stop	Jobbers and Assistants Gaters Feeler-Motion Fitters	32	32	23
	Cloth Carriers Oilers Sweepers	16	16	16
	Totals	48	48	39
	GRAND TOTALS	124	106	93

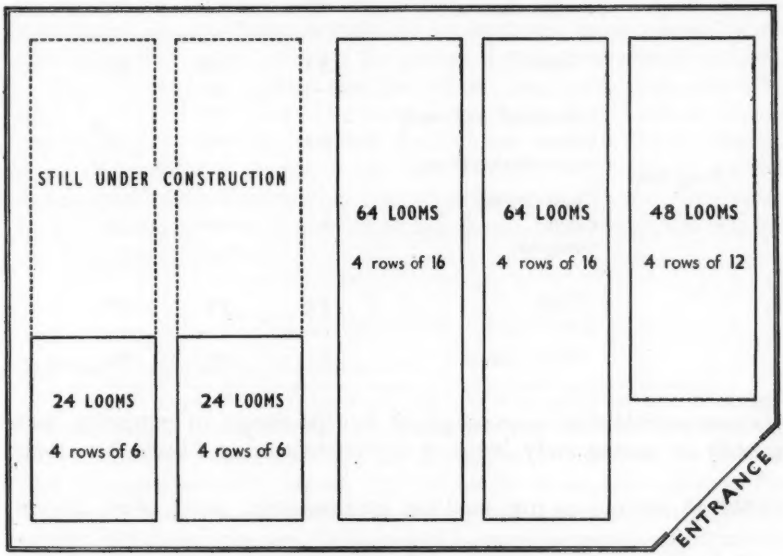
It was, therefore, decided to start an experimental group on one block of sixty-four looms, to extend this, if successful, to the other block of sixty-four looms, and ultimately to use the block of forty-eight near the entrance of the shed as a training group. The figures for the theoretical numbers of workers required for 960 looms were, therefore, reduced to the number required for sixty-four looms and the results are given in *Table 10*.

Status Differences and Titles

An examination of the status grades showed that there appeared to be three natural grades of which one would provide the group leader. These, together with their positions on the same scale based upon wages as in *Table 1*, are shown in *Table 11*. It will be seen that for the group leader the new grade

involved a small rise in pay, and that for some previously designated "unskilled" the rise was larger. At the same time, whereas previously only jobbers and weavers were paid piece rates,[6] it was proposed that all members of the experimental group should participate. It was hoped that any increased cost incurred by these changes would be offset by eliminating the need for extra supervision and inspection, and by greater efficiency.

FIGURE 3 PLAN OF EXPERIMENTAL AUTOMATIC LOOM SHED



The wide difference between Grades B and D led to the interpolation of a sub-grade C (rank 1·6) for those who had earned promotion from Grade D but had not yet acquired sufficient experience to qualify for Grade B.

It was recognized that the current titles given to occupational roles would not necessarily be appropriate to any form of reorganized internally-led small work-group, since more of the tasks would be interchangeable.

6. Piece rate was based upon an average standard efficiency of 85 per cent per month, higher or lower efficiencies resulting in proportional increase or decrease in the amount of pay excluding "dearness" (cost of living allowance) which, on the scale given in Tables I and II, was approximately 0·75, e.g., for an average monthly percentage efficiency of 87, the bonus equalled 2/85ths of the basic monthly rate (total pay less dearness allowance). For percentages over ninety-two the proportional increase was doubled; i.e., ninety-three was paid as ninety-four, etc.

TABLE 10 *THEORETICAL NUMBERS OF WORKERS REQUIRED FOR 64 LOOMS*[7]

Sub-Group	*Occupational Roles*	*Numbers Required for Each Main Sort*		
		Coarse	*Medium*	*Fine*
Short Stop	Weavers Battery Fillers	4·0	2·8	2·5
	Smash-hands Bobbin Carriers	1·1	1·1	1·1
	Totals	5·1	3·9	3·6
Long Stop	Jobbers and Assistants Gaters Feeler-Motion Fitters	2·1	2·1	1·5
	Cloth Carriers Oilers Sweepers	1·1	1·1	1·1
	Totals	3·2	3·2	2·6
	GRAND TOTALS	8·3	7·1	6·2

Various possible titles were suggested, but the danger of expressing, consciously or unconsciously, hopes or expectations led to a decision to await

TABLE 11 *STATUS GRADES FOR THE EXPERIMENTAL SMALL WORK GROUP*

Grade	*Status*	*Rank*
A	Group leader who would also be the working head of the long-stop sub-group	2·4
B	Fully experienced members of either the short-stop sub-group or the long-stop sub-group	2·0
D	Those engaged almost entirely on the "unskilled" jobs of battery filling, sweeping, oiling or carrying, but which should nevertheless be higher than that of a new unskilled entrant once they had been accepted as integral members of a working group	1·2

discussion with the supervisors and workers before trying to define either the new grades or the new roles.

7. Since, as yet, this was a purely theoretical exercise based on current work-studies, the numbers were not rounded off.

Other Aspects of the Analysis of the Socio-Technical System

The repeated examination of the occupational roles and tasks in the loom shed raised a number of other questions to which answers could not immediately be obtained or solutions, if obtainable, could not be immediately implemented. Some of these questions concerned the uniformity of the level of mechanization in the various shed operations, others would have involved analyses of other parts of the total textile manufacturing process. Time was not immediately available for the investigation of other parts of the process and changing the level of mechanization in some operations required the solution of engineering problems and the invention or development of further mechanical devices. Some alterations—for example, those related to the removal of fluff—were awaiting the arrival of equipment already ordered.

One outstanding question was that of the long loom stops caused by meal breaks and by intervals between shifts. Apart from insisting that in general the purpose of an automatic machine was to run without attention, it was decided not to suggest at once any alteration in the current practice during meal breaks. The question of intervals between shifts was complicated by trade union agreements and Indian Industrial Court awards and was left for future consideration.

III. RESULTS OF THE EXPERIMENT

Spontaneous Acceptance of Reorganization

At a meeting of the Chairman, and Mill, Works, and Personnel Managers and the author it was decided to discuss the analysis with the Weaving Master, the supervisors, and workers at once, and with their approval to start an experimental group on the one block of sixty-four looms. The Weaving Master was called into the meeting and as soon as he heard of the notion of a *group of workers for a group of looms*, he spontaneously accepted the proposed reorganization. This spontaneous acceptance by the Weaving Master provided for higher management a first validation of the "goodness of fit" of the proposed reorganization with the felt needs of those working in the experimental loom shed. The Works Manager started discussions with the supervisors on the same evening. It had been expected that it would probably take some time for the discussions to be held, first with the supervisors of each shift and then with the workers, and that the experimental group would then be chosen by the supervisors in consultation with the Works Manager and a suitable date for starting chosen. In the event, the supervisors and workers immediately took possession of the system and by the next day, by a complex sociometric process which there was no time to investigate, the workers had themselves organized two experimental groups. By the following day groups had been organized by the workers for the two blocks of sixty-four looms for both shifts, making four small work-groups

(Experimental Groups a, b, c and d). That the actual members of the groups so spontaneously chosen were not those who would have been picked by the Works Manager was considered (with some misgiving perhaps) less important than that the grouping was spontaneous and that the number in each group had been spontaneously fixed at seven. There were only medium

TABLE 12 *COMPOSITION OF EACH EXPERIMENTAL GROUP*

Grade	*Number in Each Sub-Group*		*Total*
	Short-Stop	*Long-Stop*	
A (leader)		1	1
B	2	1	3
D	2	1	3
Totals	4	3	7

counts on the particular looms and each spontaneously chosen work-group consisted of a long-stop sub-group of one Grade A, one Grade B, and one Grade D, and a short-stop sub-group of two Grade B and two Grade D. The composition of each group is shown in *Table 12*.

It was decided to allow the groups so chosen to work for an experimental period whose length would be determined by events.

The Management of the Shed After Reorganization

The immediate effect on management after the shed had settled down to this reorganization was that the number of individuals reporting directly to the Work Supervisor was reduced. Although those workers not included in the experimental groups still continued as before reorganization, those in the experimental groups were now responsible to their group leaders. In addition workers requiring training, instead of being spread over the whole shed, could now be concentrated in one loom group of forty-eight where they could receive more direct attention from the supervisors. It was decided that, as soon as the building was completed and the full complement of 304 looms installed, the other two blocks of sixty-four looms would be organized in the same way as the experimental groups. This organization would leave the Work Supervisor with four group leaders reporting directly to him and would free the Top Supervisor to give special attention to the training loom group. Instead of the shed's needing more supervision it appeared that there was every chance that the present supervisors would be under-employed.

The sophistication of higher management in permitting the shed to reorganize itself was followed by the beginning of their withdrawal from the governing system of the shed, not so much as part of a consciously deter-

mined plan but as the result of increased confidence in the ability of those in the shed to solve their own problems. In August the Chairman of the Company reported that "Whereas I always spent some time in the experimental shed every time I went to the mill (on average twice a week), I don't think I've been in it more than two or three times since it was reorganized, not because I've lost any interest in it, but because I know it is going well."

So far as the group leaders and workers are concerned, there has been no noticeable change in their attitude to the reorganization since their first spontaneous acceptance, and there have been requests from the workers not included in the experimental groups to be allowed to organize themselves in the same way. In discussion with the supervisors, the workers expressed a positive desire to avoid the old titles of their jobs but no enthusiasm for any other titles than the "A", "B" and "D" grade designations. In August (the latest information) experimental group tasks were still known by all those in the shed as "A", "B" and "D" jobs and those in occupational roles as "A", "B" and "D" workers.

In general it can be said that, as far as can be ascertained, the assumptions made about small work group organization have been proved correct.

Four Phases of the Experimental Period

A detailed consideration of the experimental period shows that it may be described in four phases:

First Phase—the eleven working days immediately after reorganization. During this phase there was an increase in the efficiency of the experimental groups but at the cost of an increase in the percentage damage and of neglect of loom maintenance.[8] This was discussed by the Works Manager with the supervisors, group leaders, and workers who expressed themselves as willing to co-operate in the attempt to reduce the damage and improve maintenance, but as unable adequately to keep down damage and keep up maintenance while maintaining the rate of working with short loom-stops at 1·5–2·0 per hour, the current rate.

Second Phase—three working days, during which the Top Supervisor took over the group leadership of one of the groups to investigate the possibility of maintaining efficiency while avoiding increased damage and decreased maintenance. As a result of this investigation during which efficiency fell considerably in all four groups, extra help at the rate of half an extra Grade D worker was given to each group (based on theoretical needs with loom stops per hour of 1·75).

Third Phase—eight working days of resettlement following the damage and maintenance investigation. In this phase efficiency climbed,

8. On the second day of the experimental period a breakdown in the humidification plant flooded a part of the shed, spoiled twenty-five beams in the experimental groups and halted the whole shed for just over an hour.

damage remained less than it had been before the experiment started and loom maintenance was restored to its former level. Discussions took place between the Works Manager, supervisors, group leaders, and workers about the running of looms during meal intervals.

Fourth Phase—the remaining thirty-seven working days of the experimental period. As a result of discussions during the third phase, looms were not stopped by the workers at the beginning of the meal break but were allowed to run on until they stopped automatically when yarn broke. The extra help given in the third phase was withdrawn.[9] After thirty-seven days a partial third shift was started working on one of the experimental blocks of sixty-four looms and on one of the groups of forty-eight. Results thereafter are not, therefore, strictly comparable with those of the experimental period.

Figures of Efficiency and Damage

The results of the comparison of the mean percentage efficiencies of the experimental groups with the mean percentage efficiency of the shed before reorganization are given in *Table 13*, and are shown diagrammatically in

TABLE 13 *MEAN PERCENTAGE EFFICIENCIES OF FOUR EXPERIMENTAL GROUPS COMPARED WITH SHED EFFICIENCY BEFORE REORGANIZATION*

Phases of Experimental Period	*Experimental Group*				
	a	*b*	*c*	*d*	*Combined*
1st. March 30–April 10 11 working days	87·7	87·9	86·5	86·4	87·1
2nd. April 11–April 14 3 working days	67·7	69·6	73·2	79·8	72·6
3rd. April 15–April 23 8 working days	84·0	86·4	83·0	86·3	84·9
4th. April 24–June 6 37 working days	95·9	96·2	94·0	94·1	95·0
Shed Efficiency Before Reorganization* March 1–March 28 23 working days	(79·8)	(79·8)	(79·8)	(79·8)	79·8

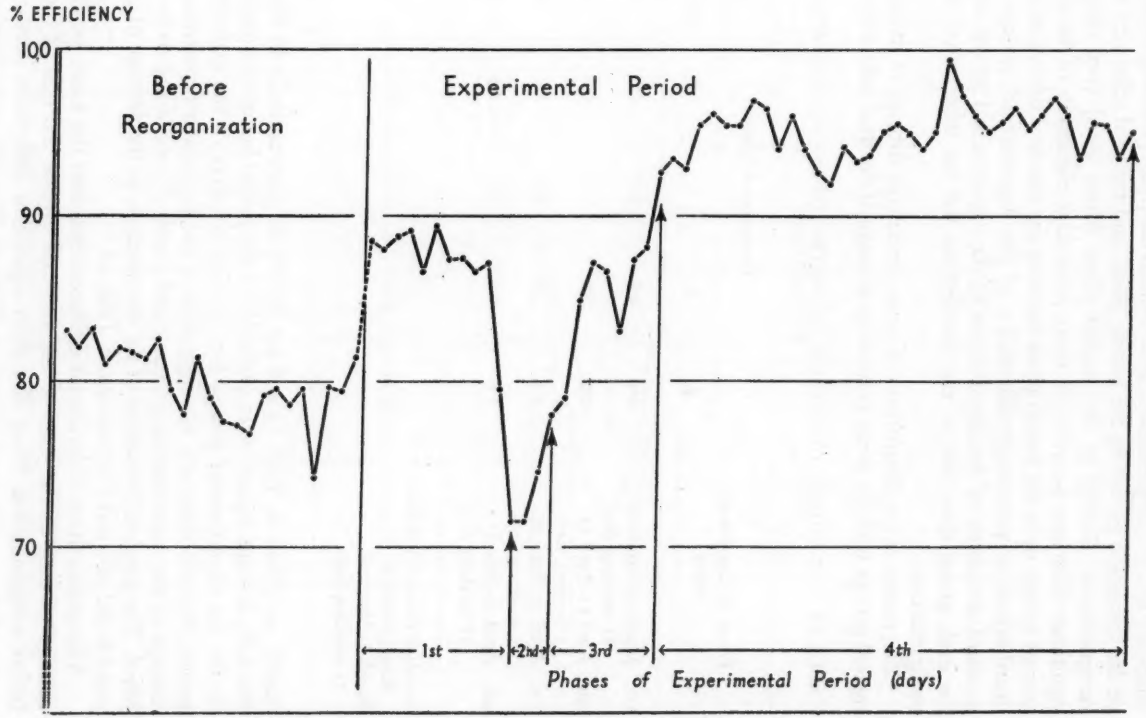
* The range of individual weaver's efficiencies before reorganization was 74·4–85·0.

Figure 4. Standard deviations of the distributions of percentage efficiencies are given in *Table 14*. (All figures are based on an eight-hour shift.)

The results show a significant difference between the mean percentage

9. This was found possible, although checks showed the loom stops still at the rate of 1·6 per hour.

FIGURE 4 PERCENTAGE EFFICIENCY BEFORE AND AFTER REORGANIZATION



efficiencies of each experimental group in the fourth phase, and the shed efficiency before reorganization, and between the mean percentage efficiency of the combined groups in the fourth phase, and the shed efficiency before reorganization. Except in the second phase (three days) they show no significant difference between the mean percentage efficiencies of the experimental groups or in the fourth phase between the standard deviations of the distributions of percentage efficiencies of the experimental groups. The standard deviations of the distributions of the experimental groups are less for each group than that of the distribution for the whole shed before reorganization.

The results of the comparison of mean percentage damage of the experimental groups with the mean percentage damage of the shed before reorgan-

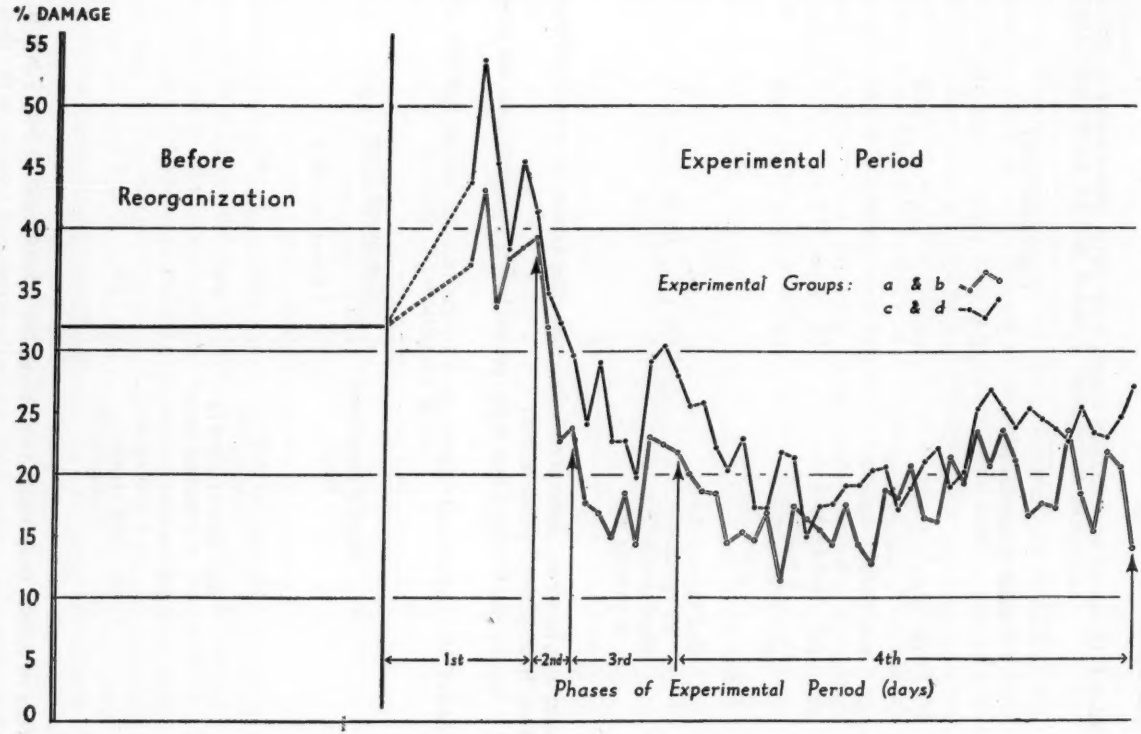
TABLE 14 *STANDARD DEVIATIONS OF DISTRIBUTIONS OF PERCENTAGE EFFICIENCIES*

Phases of Experimental Period	*Experimental Group*				
	a	*b*	*c*	*d*	*Combined*
1st. March 30–April 10 11 working days	2·4	4·9	1·8	4·0	3·6
2nd. April 11–April 14 3 working days	2·7	3·7	·7	1·8	5·2
3rd. April 15–April 23 8 working days	5·3	3·2	6·8	1·6	4·9
4th. April 24–June 6 37 working days	2·6	2·3	2·6	2·4	2·7
Standard Deviation Before Reorganization March 1–March 28 23 working days	(3·1)	(3·1)	(3·1)	(3·1)	3·1

ization are given in *Table 15* and are shown diagrammatically in *Figure 5*. No daily damage figures were available for the period before reorganization or for the experimental groups for the first six days of the experimental period. Because there was no night shift in the Inspection department, the damage of the experimental groups *a* and *b* and of *c* and *d* had to be combined. The standard deviations of the distributions of the damage of groups *a* and *b* and of *c* and *d* are shown in *Table 16*.

The results show a significant difference between the mean percentage damage of each of the pairs of experimental groups and that of the shed before reorganization. They also show significant differences between the means of the experimental groups in all phases. The differences between the means of experimental groups can be accounted for by difficulties with

FIGURE 5 PERCENTAGE DAMAGE BEFORE AND AFTER REORGANIZATION



humidification during construction, which affected the sixty-four looms near the new building more than the others. The boundary of the affected

TABLE 15 *MEAN PERCENTAGE DAMAGE OF FOUR EXPERIMENTAL GROUPS COMPARED WITH SHED DAMAGE BEFORE REORGANIZATION*

Phases of Experimental Period	*Experimental Group*		
	a & b	*c & d*	*Combined*
1st. April 6–April 10 5 working days	37·8	45·5	41·6
2nd. April 11–April 14 3 working days	31·2	36·2	33·7
3rd. April 15–April 23 8 working days	18·8	25·7	22·3
4th. April 24–June 6 37 working days	17·8	21·9	19·9
Shed Damage Before Reorganization March 1–March 28 23 working days	(31·8)	(31·8)	31·8

area was, however, difficult to define, and other factors (at present unknown) may have affected performance.

It may also be noted that in the period before reorganization the propor-

TABLE 16 *STANDARD DEVIATIONS OF DISTRIBUTIONS OF DAMAGE OF FOUR EXPERIMENTAL GROUPS*

Phases of Experimental Period	*Experimental Group*	
	a & b	*c & d*
1st. April 6–April 10 5 working days	3·2	4·8
2nd. April 11–April 14 3 working days	7·1	3·8
3rd. April 15–April 23 8 working days	3·5	4·3
4th. April 25–June 6 37 working days	3·2	3·3

tion of looms to workers (excluding the humidification fitter) was in the proportion of 8 : 1; that if eventually the number of workers in the shed had been found adequate to man 240 looms, the proportion would then be

8·6 : 1; and that in the experimental groups the proportion was 8·5 : 1 during the period when extra help was given, and 9·1 : 1 after it was withdrawn.

Limitations of the Findings

The findings of the experiment are those of operational research. It was not possible, within the circumstances of the experiment, to relate the findings to the ecological background of economic, industrial, or cultural conditions in India nor, because of language difficulties, was it possible to relate them to the attitudes and relationships of the supervisors and workers of the loom shed itself. The only evidence of the "goodness of fit" of the analysis was its spontaneous acceptance, rapid implementation and continuity. It may, however, be inferred that, by being permitted to implement their own reorganization, the workers were given a first experience of their own capacity to create an internal structure; and that management, in its turn,

TABLE 17 *EFFICIENCY AND DAMAGE FIGURES FOR REST OF LOOM SHED DURING EXPERIMENTAL PERIOD*

Phases of Experimental Period	*Efficiency Percent*	*Damage Percent*
1st. April 6–April 10 5 working days	71·0	42·7
2nd. April 11–April 14 3 working days	66·6	40·5
3rd. April 15–April 23 8 working days	68·9	26·6
4th. April 25–June 6 37 working days	81·4	23·0
Shed Before Reorganization March 1–March 28 23 working days	79·8	31·8

was able to accept the internal structuring of small work groups as a method of management and as an alternative to additional imposed external structure.

An examination of the efficiency and damage results in the rest of the shed, that is, the looms other than those included in the experimental groups, strongly suggests the effects of forces of induction from the experimental groups. Theoretically the rest of the shed continued with the previous form of organization during the experimental period. The formation of the experimental groups, however, had an inevitably disturbing effect on the whole shed and involved a reallocation of tasks and work loads among the rest of the workers. This disturbance, apart from any of the effects of being left out of the experiment, would have led to the expectation of induced negative

forces in the experimental period. These expectations were confirmed by the results but only in the first three phases of the experimental period. During the fourth phase the mean percentage efficiency of the rest of the shed was 81·4 (shed efficiency before reorganization 79·8), and the mean percentage damage was 23·0 (shed damage before reorganization 31·8). The full figures are given in *Table 17*. The view that this improvement was a reflection of the success of the experimental groups was supported by a request from the workers in the rest of the shed to be allowed to reorganize themselves in the same way as had the experimental groups. Action was deferred until the end of the experimental period.

There is, as yet, no adequate information about the effects and repercussions in the rest of the mill. There have been no known adverse effects and some favourable interest has been shown. As far as can be ascertained, social, economic, and technological conditions both outside and inside the mill and loom shed remained constant throughout the period for which results are reported in this paper. The only known change is that of climate which grew steadily hotter from the beginning of March to the end of July.

On June 7th a partial third shift was started on one of the experimental groups of sixty-four looms and on one of the groups of forty-eight. The shift was started with new and comparatively inexperienced workers. It provided the opportunity for the up-grading of some of the members of the experimental groups and the reallocation of some tasks. The results since June 7th are not, therefore, comparable with those of the experimental period. The mean percentage efficiency of the whole shed for all shifts for the period June 8th–August 22nd (the latest figures available) was, however, 90·3 (before reorganization 79·8) and the mean percentage damage was 24·5 (before reorganization 31·8). The Works Manager comments, "... these results have coincided with the most difficult part of the year, working conditions are severe and absenteeism maximum ...".

SUMMARY AND CONCLUSIONS

1. An experimental automatic loom shed which contained 224 looms was manned by twenty-nine workers, of whom twenty-eight were concerned directly with the manufacture of cloth and one with artificial humidification.

2. The activities of a single automatic loom are cyclic—load, weave, unload—and require the successive performance of tasks to carry them out. The activities of a loom shed containing a number of looms are continuous, and require the simultaneous performance of tasks to maintain the continuity.

3. The weaving process had been broken down into component tasks and the number of workers allocated to different tasks had been determined by work-studies of the separate components.

4. The looms in the shed were differentiated into nineteen different loom groups of five kinds which overlapped in different degrees. Each kind of loom group contained a different number of looms—groups which were manned by a different number of workers. There were eight loom groups of 24–32 looms manned by one weaver to each group; five loom groups of 40–60 looms manned by one battery filler to each group; three loom groups of 60–80 looms manned by one smash-hand to each group; two loom groups of 112 looms, manned by one jobber, one assistant jobber, one gater and one bobbin carrier to each group; and one loom group of 224, manned by one feeler-motion fitter, one cloth carrier, one oiler, one sweeper and one humidification fitter.

5. All tasks of the manufacturing process were interdependent, but the workers performing them worked in different kinds of loom-groups and had, therefore, different degrees of interdependence. Some were virtually independent of each other. Thus a weaver had on average the services of one-quarter of a pair consisting of jobber and assistant jobber, five-eighths of a battery filler, three-eighths of a smash-hand, and so on.

6. The resultant pattern was of an aggregate of individuals with confused task and worker relationships and with no discernible internal group structure. This resultant was compared and contrasted with the longwall method of coalmining in which job breakdown in a predominantly cyclic process had led to a similar lack of internal work-group structure but with splitting and segmentation rather than confusion.

7. Change of sort (kind of cloth woven) led to a restructuring of some kinds of loom group and in consequence to a change in the pattern of relationships.

8. Higher management had provided reinforcement for the governing system of the shed. This, and the high quality of the relationships between supervisors and between supervisors and workers, had prevented any overt difficulties resulting from the lack of group structure, but in the shed efficiency was lower and damage was higher than target figures.

9. In spite of the persistence of "weaver" as a title for an occupational role the weaver was the loom, and all workers, including the "weavers", serviced the machines. The tasks performed were found to be differentiated into two main groups: those concerned with short loom stops (after a simple yarn break) and those concerned with long loom stops (for loading and unloading and loom maintenance, for meal intervals and between shifts). During shift hours two worker sub-groupings appeared possible—the short-stop sub-group and the long-stop sub-group.

10. An analysis of changes in the numbers of workers with change of sort showed that relatively stable numbers could be obtained for each of three main groups of sorts—coarse, medium, and fine—and that provided some tasks could be considered interchangeable no changes in worker groups would be required for changes within the main sort. The theoretical numbers

required for blocks of sixty-four looms, into which the loom shed was divided by physical boundaries, were calculated.

11. Three natural grades within a worker group for sixty-four looms were found. They were designated by letters only, rates slightly in excess of existing rates were fixed for these grades and it was decided to pay piece rates to the whole group.

12. It was decided by higher management to discuss with mill and shed management and the workers the organization of one experimental work group for a group of sixty-four looms.

13. Shed supervisors and workers spontaneously took possession of the reorganization, and the workers themselves immediately organized four experimental groups. Higher management took no part in the discussions with supervisors and workers and permitted the experimental groups so chosen to start work.

14. The results of the experiment were:

(*a*) The creation of internally-structured and internally-led small work-groups.

(*b*) A reduction in the number of those reporting directly to the supervisors and a consequent strengthening of the executive command.

(*c*) The beginning of the withdrawal of higher management from the governing system of the shed.

(*d*) Old occupational role titles were abandoned but new titles were not chosen. Five months afterwards both tasks and roles were still known by the letters designating the grades.

(*e*) After an immediate increase in mean efficiency in the experimental groups at the cost of increased damage and inadequate maintenance, a settling down at a new level of performance in which efficiency was higher and damage lower than before reorganization.

15. These results could not, in the time available, be related to the general ecological background of economic, industrial or cultural conditions in India, nor because of language difficulties could any direct evidence of the workers' attitudes and feelings be obtained. The only evidence of "goodness of fit" was the spontaneous acceptance, implementation, and continuation by the workers, and the withdrawal from the governing system of the shed by higher management.

16. The rest of the shed showed some evidence of the incidence of forces of induction, but this evidence could not be followed up in the time available. The experimental period finished when a partial third shift was started. No adequate information was available of repercussions in the rest of the mill.

17. Although, therefore, all the effects cannot at present be related to their causes, and the analysis has not yet been followed completely through, it seems fair to conclude that the findings reported had a direct relationship to the event of reorganization. The exploration has led to arrangements for future collaboration. It is hoped, therefore, to follow up the experiment

reported in this paper and to publish further reports as results become available.

REFERENCES

1. KATZ, DANIEL, and KAHN, ROBERT L. "Human Organization and Worker Motivation", *Industrial Productivity*, pp. 146–71. Editor L. R. Trip, Industrial Relations Research Association, 1951.
2. RICE, A. K., and TRIST, E. L. "Institutional and Sub-Institutional Determinants of Change in Labour Turnover", *Human Relations*, Vol. V, No. 4, 1952.
3. ROETHLISBERGER, F. J., and DICKSON, WILLIAM J. *Management and the Worker*. Cambridge, Mass.: Harvard University Press, 1939.
4. TRIST, E. L., and BAMFORTH, K. W. "Some Social and Psychological Consequences of the Longwall Method of Coal-Getting", *Human Relations*, Vol. IV, No. 1, 1951.

BIOGRAPHICAL NOTE

A note on the author of this paper appeared in *Human Relations*, Vol. III, No. 4.

THE DIMENSIONS OF SYNTALITY IN SMALL GROUPS[1]

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1. HISTORICAL BACKGROUND

Hypotheses and experimental designs in group research deal with (a) the properties of groups and (b) the characteristics of individuals, in relation to one another or to various influences. It has astonished the present researchers that many serious writers are apparently prepared to indulge in verbally involved theories without having investigated the first essential fundament in these relations, namely, (a) above—the dimensions along which the attributes of any group are to be quantified. A theoretical statement of this problem was presented by Cattell in 1948 (1) and a demonstration research on 21 groups, of six women in each, was published by Cattell and Wispe (7) shortly afterwards. But otherwise—save for a theoretical appreciation of this work by Gibb (11), Hemphill (12) and Thorndike (18)—social psychology seems to have attempted little progress toward this goal, prior to the present research.

A large-scale investigation on leadership, group structure, and group syntality—of which this is the initial report—was begun immediately after the Cattell-Wispe pilot study, with assistance from the Office of Naval Research. While the pilot study has been criticized (18) for factorizing on a basis of only 21 groups, it was indeed never intended to fix reliably the dimensions of group behavior, but only to call attention to what seemed the best possible methodological solution to the dimension problem, and to explore its technical difficulties preparatory to a research on a larger scale. The studies of Gibb (11) and Hemphill (13) aimed at the same theoretical goal, were also on only a small population of groups, and the latter used rating rather than objective test methods, without the factorial technique here advocated.

Nevertheless, if one is to face squarely the problem which stands athwart the path of progress in group behavior research he must recognize that the

1. The work described in this paper was accomplished under Contract NR 172-369 sponsored by the Human Relations Branch, Office of Naval Research.

dimensionality solution can only be obtained—even for any one sub-species of group—by a research planned and executed over several years with (a) a population of at least seventy groups, (b) a very catholic set of group behavior manifestations, covering at least eighty to a hundred variables, experimentally measured, and (c) a technically adequate factor analysis of this massive data. A consideration of the combination of experimental, statistical and organizational skills required, in relation to the training and resources current in social psychology will perhaps explain why this theoretically so essential experimentation has been so long deferred.

2. THEORETICAL BACKGROUND

For the researcher who has not read the growth of theory and research results in this area (1, 2, 4, 6, 7, 11, 12) neither the ensuing account of experiment nor the above historical retrospect can be quite intelligible without a brief section on theoretical background.

Our definition of a group is "an aggregate of organisms in which the existence of all is utilized for the satisfaction of some needs of each". This generally, but not invariably, *includes* the more frequently offered definition as a set of "interacting individuals" (10). The main sub-types of groups to be considered are: (a) overlapping vs. non-overlapping (requiring reference to the degree to which members get the remainder of their satisfactions from other group memberships), and (b) newly-formed vs. traditional. No group, however new, avoids the traditions carried by its members from other groups. These import potential structure which tends quickly to realize itself. Yet we must distinguish between this and the explicit institutions-in-being of a long established group.

Our aim is to establish the chief functionally meaningful group dimensions, but it must be recognized that every factorization or other analysis of dimensions presupposes a defined species—a prior statement of degrees of homogeneity in the population—within which the dimensions obtain. Hemphill's work (13) on the natural history of groups has helped clear the ground for recognizing these species. The species of group we have thought it most desirable to structure in this first application of factor analysis to the field *is that which is most common in all sorts of current small group experimentation* [2] *and may be defined as a face-to-face group of six to a dozen young men, newly formed and with no tradition other than those potential in their cultural and biological backgrounds, without imposed formal leadership or structure, and motivated by possibilities of common gain amounting to 100 dollars (1948–50 value) through successful group performance in presented problem situations.*

2. And also, as James's survey shows (15), as most common in everyday life situations of committees, neighbor groups, parties, small public meetings, etc. etc.

One of the basic concepts of our work is that the description and measurement of a group requires data on three panels: (a) *population characteristics*—the statistics of the distribution of traits of the individual group members as such, e.g., average intelligence; (b) *structure*, e.g., form of leadership, status, roles, interaction, etc., and (c) *syntality*, that which is defined by the attributes of the group *as* a group, i.e., by its measured performances as an integrated whole.

Syntality characteristics, as the Cattell-Wispe exploratory study shows, are likely to be of all modalities—cognitive, temperamental and dynamic. For example, the Cattell-Wispe study indicated a factor of general "group intelligence" similar to individual "g", three factors in the area of morale and group integration, and a dynamic factor of group aggressiveness. It is unitary syntality traits of this kind that we are most concerned to discover, define, and measure, though we are also interested in population and structural measures.

The nature of these dimensions emerges from the cycle of experiment—hypothesis formulation—experiment. In this field, where possible variables are so numerous that hypothesis formation and testing by the usual laws of univariate (dependent-independent variable) experimentation is hopelessly ineffective, we have insisted that the only effective tool is factor analysis, which has already proved itself in the corresponding chaotic field of personality variables. The time for profitable experiment with controlled variables will come when the important dimension variables have been factor-analytically separated out from the vast sea of possible variables—including those which are merely subjectively chosen by some investigators as important.

Nevertheless, some of the hypotheses on which we have chosen our variables have been partly *a priori* concepts. Chief among these are the concept of synergy and the subsidiary concepts of effective synergy and maintenance synergy. If the interest of each member in belonging to a group is represented by an ergic attitude vector (3), then the vector sum of these attitudes of all members represents the total interest which the group can command. The energy of the total interest we have called the group *synergy*. It has a number of important properties, including the fixing of the degree of cohesiveness (10) or viscidity (13) shown by the group. The group synergy is thus likely to be one of the factorial dimensions (functional unities) falling in the dynamic section of the group syntality dimensions. Effective synergy is that portion of group synergy which is devoted to attaining the group goal, while maintenance synergy is the portion utilized in maintaining the group and the group process. These are represented in our variables.

Our aim in the investigation now to be described may therefore be stated as an attempt

(a) to discover in a very catholic and highly varied array of group

measurements a more limited, manipulable, representative set of independent primary dimensions *of syntality*, on which further experiments of all kinds by diverse methods of experimentation can be based.

(b) To choose some of our large pool of variables also in terms of our structural and synergy hypotheses so that our factors are also used hypothetico-deductively.

(c) To determine at the same time relations between syntality dimensions and structural and population variables. For each factor is a statement of the extent to which a syntality trait is determined by such structural variables as leadership and sociometric conditions and by the personality characteristics of persons in the group.

3. THE EXPERIMENT

We aimed to obtain measures on 100 groups of 10 men each, the men being more varied in intelligence and education than students. Each group was to meet for 3 sessions, of about 3 hours each, of group behavior, spread over a week or two, and in addition the group members were to meet as individuals *before* the group sessions for 2 hours of individual personality and background testing. These main objectives of data gathering were achieved except that through absences of individuals at one group session or another we eventually based our factor analysis on only 80 complete groups. Forty of these were composed of men beginning training in the USAF OCS, at Lackland AFB, twenty of recruits newly arrived at Great Lakes Naval Training Center, and twenty of students in social psychology classes at the University of Illinois. Anyone familiar with this field will recognize that the requirement of completeness of group records makes the collection of adequate numbers of groups particularly arduous in comparison with individual research.

In accordance with our definition of a group as something more than a collection of people in the same room working side by side to please the experimenter, we provided the motive of $100 to be paid to the best group in each consecutive set of 10 groups and *to be obtained only by group, rather than individual, performance.*

As to structure, the first 3 hour session was without explicit injunction to adopt a leader, but, after the experience of this first session, all groups received the experimenter's invitation (accepted without exception) to elect a leader with stated powers, for the better performance of the group in inter-group competition. *The present report deals only with the first sessions of the 80 groups, without formal leadership*, with which the findings of the two later sessions may be contrasted to bring out the developments of syntality with age.

The choice of variables included in the matrix was as follows:

A. *Population Variables.* Measures were taken with a research form of the

16 Personality Factor Questionnaire (8, 9), Forms A and B, 1½ hours, of the primary personality dimensions, including such source traits as general intelligence, surgency, cyclothymia-schizothymia, and emotional stability. The individual measures also included (a) measures on a variety of attitudes and interests before and after group decisions on them, thus comprising both an absolute and a shift score, and (b) the interaction observations, e.g., number of suggestions made, broken down in terms of individuals.

B. *Group Structural Variables.* Here, we aimed at meeting three conditions: 1. to include, as stated at conclusion of the last section, marker variables (5) for the factors already approximately indicated by the Cattell-Wispe study and now presenting hypotheses for testing, 2. to include an extremely varied array, covering also most situations of practical value in every day life group situations, e.g., committee decisions, jury harangues, physical panic situations, group honesty in dealing with other groups, group interests, efficiency in mechanical construction, group learning, constancy of group intentions, etc., 3. to include situations to test hypotheses about the nature of group synergy, effective and maintenance synergy, etc. It will be noticed that in no case are the syntality measures permitted to be mere sums of individual performances.

In regard to the experimental and statistical design the following points are important: (a) Reliability coefficients were planned whenever possible, both to test the consistency of syntality as a concept and also to permit corrections of subsequent factor loadings for attenuation; (b) The total set of variables eventually reached was distributed among the three sessions in such a way as to permit all to be factorized without having too large a matrix, also to permit developmental observations by repetition of some variables and, especially, as a statistical device to permit the three factorizations to be related. The actual situations in which group performance and structure measures were obtained were (note the syntality section of our list begins at 30):

30. *Construction.* A rough diagram, and dowel stick materials sufficient to reproduce it in three dimensions, were presented to the group. It is told that its task is to construct the model building shown in the diagram and that its score for the task will be the time it takes to do it. No instructions are given as to how the task might be accomplished. The group is given a distribution of time scores made by similar groups. Before beginning, it estimates the time that will be required. Upon completion, it is told its time, then asked to repeat the entire process.

31. *Group Judgment.* The group is given, one at a time, four questions of fact (e.g., "What was the ideal minimum subsistence budget in 1939 for a family of four?"). They were allowed two minutes to discuss each and required to submit an answer at the end of that time. They were told that if a correct answer was submitted in less than two minutes, they would receive a bonus that increased as their time shortened.

32. *Attitude.* The subjects were given a 21-item attitude scale consisting of statements taken from the Thurstone scales on birth control, church, war and communism (19). He was asked to indicate his agreement on a seven point scale (ranging from "absolutely certain" to "absurd"). Two of these same statements were later presented to the group as "sentences taken from recent American or foreign newspapers". They were told that the group was to discuss each statement for four minutes during which time they were to try to decide what the statement meant, and how they felt about it. Following each discussion the group voted, by a show of hands, on the same seven point scale, and the mean position of all votes was announced. This average was reported as the "group opinion". At the end of the situation the individual members again indicated their private responses to each question that the group had discussed as a part of the sociometric measurements for that situation.

33. *Guessing Game.* E. answered either "yes" or "no" to questions asked him by the group members. They were instructed to try to discover of what object E. was thinking. They were told that they were limited as to time but not as to the number of questions and that their score was cut more by an excess of questions than by lack of speed. The "objects" varied from an "easy" item (the Eiffel Tower) to a "very difficult" one (the concept of goodness). The time limit (at which penalties began), not told to the group, was three minutes on each item.

34. *Dynamometer.* (This situation was used for the last 40 groups only.) Two steel pipes, 1 inch by 30 inches, were placed one at each end of a dynamometer. The group members were given pieces of canvas to fit over their shoes and were placed on a heavily waxed floor. They were given 30 seconds to get the dynamometer hand as high as possible, and were told that this could best be done by jerking. After trying for 30 seconds their score was read to them, they were asked to estimate what they would do on a repeat performance, then invited to repeat the task.

In a second sub-test the group was instructed to maintain a steady pull for 15 seconds and told that the lowest point to which they allowed their pull to fall would be their score. (A continuous reading was visible.) No practice trials were permitted, but as much time as desired was allowed for planning and organization. Again, following the first performance, an estimate and then a repeat performance was obtained.

35. *Interests.* Immediately after the attitude test was given and just before the group was to begin functioning as a group, each member was asked to indicate privately the relative strength of *his* interests at that moment in a list of 11 activities selected so as to involve as many as possible different basic human needs and to vary in the amount of interaction likely to be involved in doing them. About two hours later the entire group was asked to discuss the same list of possibilities, apparently

for the purpose of selecting one of them as a group activity for future meetings. After discussing the possibilities for 6 minutes, the group ranked them in order of preference, and finally cast 100 votes divided among as many activities as it wished. Following this, as a part of the sociometric ratings, the original "interest" form was again filled in by each member privately with instructions to indicate "how you now feel".

36. *Card Sorting.* On the front side of the experimenter's table was placed a sheet of heavy cardboard, 11 by 42 inches, divided into fifteen squares numbered 5, 10 . . . 75. Above some of the squares "red" was printed, above others "black", and above still others there was nothing. On this cardboard, a stack of especially selected playing cards (without face cards) was placed. The group was told that their task was to sort this stack of cards into 15 piles and place each in the appropriate square. They were told that there was a time limit but not what it was (6 minutes) and that their score depended on both speed and accuracy.

37. *Discussion.* The final activity was described to the group as an opportunity for it to discuss what it had done, how it could have done better, what things it found most interesting, what it disliked about the experiment, etc. This discussion was allowed to run for 6 minutes, immediately after which the group ranked its preferences among the various situations which they had done.

4. THE FACTOR ANALYSIS AND ITS TABLES

Ninety-three variables, described in *Table 1*, were intercorrelated using the product moment formula. Several of these variables are extracted from the syntality performances listed above, but the latter are separately listed to make abbreviation of *Table 1* possible.

TABLE 1 *LIST OF VARIABLES DESCRIBING THE GROUPS*[3]

The first 32 variables are means and variances of the population on the 16 Personality Factor Test (8).

1. PTM: *Friendly cyclothymia v. taciturn schizothymia.* (A) People scoring high on this personality dimension prefer situations involving interaction with people; those scoring low prefer not to deal with people but rather with inanimate objects. (*001·1*)[4]

3. The correlation matrix, together with the unrotated factor matrix and the transformation matrix may be obtained by application to the American Documentation Institute, Science Service Bldg., 1719 N. Street Northwest, Washington, D.C., by reference to number 3678.

4. In order to facilitate cross reference between factor analyses in this study an index number was assigned to each measurement, such that the *area* from which the measure comes is indicated by the first digit, the particular measure, and in the case of syntality measures the situation in which it was taken, by the second and third digits. To some extent the mathematical treatment given it is indicated by the numbers, if any, to the right of the decimal point. The convention used is as follows:
000–099. Population measurements (PT), such as mean personality measurements.
100–199. Sociometric measurements (SR), i.e., all ratings made by the group members.
200–299. Observer ratings (OR), of the group or of its members.

2. PTM: *General Intelligence.* (B) The measure used is largely one of analogies and classifications (verbal). (*002·1*)
3. PTM: *Emotional Maturity v. General Neuroticism.* (C) People scoring high on this measure are not greatly bothered by drives which cannot be satisfied immediately. They do not lean much on defense mechanisms to channelize their basic needs into socially acceptable-behavior patterns as much as do people who are lower on this dimension. (*003·1*)
4. PTM: *Dominance.* (E) High scores in this dimension are associated with assertiveness in social relations. As measured here this assertiveness tends to be associated with traces of egoism, some person-directed aggression and a lack of inhibition rising from self-consciousness. (*004·1*)
5. PTM: *Surgency v. Desurgency.* (F) People high on this trait tend to be carefree and enthusiastic, and to enjoy situations in which there is bustle and excitement. People low in this scale are more serious, anxious and reserved and feel more at home in more stable situations. (*005·1*)
6. PTM: *Positive Character integration.* (G) High scores on this trait are found in people who have interiorized social norms and use them as rules of conduct. They tend to value perseverance and efficiency as ends in themselves. (*006·1*)
7. PTM: *Adventurous cyclothymia v. self-conscious, withdrawn schizothymia.* (H) On this dimension variation is from outgoing sociability, adventurousness and strongly expressed emotional responsiveness, to general shyness and timid withdrawal. (*007·1*)
8. PTM: *Tender minded sensitivity v. hard headed practicality.* (I) People who score high in this dimension are described as impatient and demanding, but gently, sensitive and esthetic. The opposites are self-sufficient, tough, practical and realistic. In a college population students studying horticulture and the fine arts have been found to score high while students studying engineering and business administration score low on this factor. (*008·1*)
9. PTM: *Paranoid suspiciousness v. lack of this trait.* (L) High scores here correlate with jealousy, suspicion and self-centeredness. These people tend to avoid accepting the suggestions of others and devote rather more than the usual amount of time to examining the effects of their behavior in their associates. (*009·1*)
10. PTM: *Bohemian aggressiveness v. practical concernedness:* (M) The person high in this trait professes a disregard for social norms and for the effect of his behavior upon others, but show some conversion hysteric behavior. The opposite pole shows anxiety to do the right thing and a tendency to become emotionally involved in what happens to others. (*010·1*)
11. PTM: *Polished fastidiousness v. rough simplicity.* (N) People who score high in this dimension are socially sophisticated, intellectually trained and aloof. The opposites are clumsy but more warm-hearted. (*011·1*)
12. PTM: *Worrying, suspicious anxiety v. calm trustfulness.* (O) On this dimension variation is from subjectively felt free-floating anxiety with excessive concern over trivial

300–999. Measurements of group performance.
Mathematical treatment:
·0 A raw score.
·1 A mean.
·2 Variance.
·3 A level of aspiration measurement.
·4 A ratio.
·5 Not used.
·6 An increment, computed by taking the difference between measures of similar performances.
·7 Miscellaneous, locally defined measures making use of special treatments or of selected parts of the available data (see, for example, 201·7).
These index numbers are indicated in parenthesis after the description of each variable.

mistakes, an inability to relax, and an aversion to undertaking any but routine tasks—to the opposite characteristics. (*012·1*)

13. PTM: *Radicalism v. conservatism.* (Q_1) High scores here are associated with a willingness to subject conventions and authority to examination with a possibility of rejecting or modifying them. They also indicate intellectual and "rational" as opposed to concrete and "matter of fact" interests. (*013·1*)
14. PTM: *Independent self-sufficiency v. lack of resolution.* (Q_2) High scores here are made by people who are very self-contained and accustomed to deciding their own fate, with little regard to the reactions of the group. They tend to be task-oriented rather than gregariously oriented. (*014·1*)
15. PTM: *Deliberate will control v. lack of independence.* (Q_3) High scores here indicate people who are "strong willed", restrained, and who consciously maintain long term goals and values. In contrast to people high in Q_2 above, these people may *feel* the social pressures and temptations but they reject them if incompatible with the ethical values. (*015·1*)
16. PTM: *Nervous tension.* (Q_4) This dimension is a measure of liability physical symptoms of nervousness especially over-activity of the vegetative nervous system. (*016·1*)
17. PTV: *Friendly cyclothymia v. taciturn schizothymia.* (A) (*001·2*) (*This and the scores following through 032 were obtained by computing the squared standard deviation of the distribution of individual group members' scores for personality traits numbers 1 through 16 above.*)
18. PTV: *Population variance. General intelligence.* (B) (002·2)
19. PTV: *Emotional maturity.* (C) (003·2)
20. PTV: *Dominance.* (E) (004·2)
21. PTV: *Surgency.* (F) (005·2)
22. PTV: *Positive character integration.* (C) (006·2)
23. PTV: *Adventurous cyclothymia.* (H) (007·2)
24. PTV: *Tender minded sensitivity.* (I) (008·2)
25. PTV: *Paranoid suspiciousness.* (L) (009·2)
26. PTV: *Bohemian symbolic aggressiveness.* (M) (010·2)
27. PTV: *Polished fastidiousness.* (N) (011·2)
28. PTV: *Worrying suspicious anxiety.* (O) (012·2)
29. PTV: *Radicalism.* (Q_1) (013·2)
30. PTV: *Independent self-sufficiency.* (Q_2) (014·2)
31. PTV: *Deliberate will control.* (Q_3) (015·2)
32. PTV: *Nervous tension.* (Q_4) (016·2)
33. SR: *Number of satisfactory co-workers.* Mean number of people which the group members indicate they would like to retain in the group at its future meetings. (*101·1*)
34. SR: *Number of negative effecters.* Mean number of people which the group members indicate have hindered more than they have helped the group. (33, 36, 37) (107·1)
35. SR: *Number of significant members.* Mean number of members without whom the group would have been significantly different. (37) (108·1)
36. SR: *Rated enjoyment.* Mean position on an 8 point scale, at which the members rated their enjoyment of the various situations. (32, 36, 37) (117·1)
37. SR: *Felt freedom to participate.* Mean position, on an 8 point scale of personal feeling of freedom to bring up objections and partly formulated suggestions. High scores indicate freedom. (32, 36, 37) (118·1)
38. SR: *Felt acceptance.* Mean position with regard to how much the individual member felt that he was accepted as a member of the group. High scores indicate felt acceptance. (30, 31, 32, 37) (119·1)
39. SR: *Optimism for group's future interaction.* Mean rating of how well the group will work together in future meetings. High scores indicate judged improvement. (37) (122·1)

40. SR: *Commonness of purpose.* Mean rating of the extent to which individual members were striving toward a common end in the group activities. High rating indicates judged commonness of purpose. (36, 37) (124·1)
41. SR: *Integration.* Mean rating of extent members felt that they behaved as a unified group, rather than a disjointed collection of individuals. High score indicates rated high integration. (30, 31, 32, 33, 36, 37) (125·1)
42. SR: *Satisfaction with overall efficiency.* Mean rating of how satisfied members were with the efficiency with which the group reached decisions. High score indicates satisfactions. (31, 32) (126·1)
43. Guessing game: *Total number of questions asked for the "easy" item.* (331a·0)
44. Guessing game: *Total number of questions asked for the difficult item.* (331b·0)
45. Guessing game: *Rate of questioning (seconds per question) for the "easy" item.* (331a·4)
46. Guessing game: *Time required to get answer for the easy item.* (332a·0)
47. Card sorting: Number of stacks correct. (360·0)
48. Card sorting: *Rate of completion* (seconds per stack correctly completed). (361·1)
49. Discussion: Speed of ranking. Time to determine rank order of preferences divided by number of items ranked. (370·1)
50. Interests: Speed of ranking. Time required to decide on and rank 11 interest items. (350·0)
51. Interests: *Speed of voting.* Time required to divide 100 votes among the interest alternatives previously ranked. (351·0)
52. Construction: *Planning time.* Total time, for two trials, taken to decide in estimate and to plan attack on the problem. (301·1)
53. Construction: *Decrease in planning time.* Planning time for trial 1, divided by planning time for trial 2. (301·2)
54. *Group Judgment: Accuracy.* Total number of points awarded on the basis of accuracy of answers on 4 questions. (310·1)
55. Group Judgment: *Speed of reaching decisions.* Total time, within allowable limits used for reaching four decisions. (311·1)
56. Construction: *Speed.* Time per unit of work completed. Mean for two trials. (·25) (300·1)
57. Construction: *Learning.* Score 314 computed for each trial separately. Trial then subtracted from trial 2. (304·61)
58. Construction: *Realism of aspiration.* The absolute value for: $A'' - \frac{p' + pa}{2}$. Where A'' is the estimate made for trial 2, p' is the first performance and pa is the reported average for other groups. (302·310)
59. Construction: *Optimism of aspiration.* The expression under 59 above, with sign attached. (302·3)
60. Construction: *Inconstancy of aspiration.* Absolute amount of difference between the aspiration estimates. (302·33)
61. Construction: *Absolute level of aspiration.* Sum of the estimates for two trials. (302·34)
62. Discussion: *Rank of preference for construction situation.* (371a·4)
63. Discussion: *Rank of preference for group judgment, situation.* (371b·4)
64. Discussion: *Rank of preference for attitude situation.* (371c·4)
65. Attitude: *Group radicalism score.* The group vote (on a seven point scale) with "radical" scored at the 7-end times the Thurstone weight for the statement. Mean of all statements discussed. (320·1)
66. Attitude: *Quantity of change,* without regard to direction, in private responses of individual members following group discussion and vote on the statement. (050·1)
67. Attitude: *Decrease in variance* of the distribution of individual responses following group discussion and vote in the statement. (050·2)

68. Dynamometer jerking pull. *Increase* in level of pull attained for second trial over level for first trial. (340·6)
69. Dynamometer: *Optimism of aspiration.* The algebraic value for (A″ EP/n) where *A″* is the estimate made for the next trial, and *EP/n* is the mean performance for previous trials. No norms were reported and no estimate was made for the first trial. (343a·321)
70. Dynamometer jerking pull: *Total pull.* Highest pull attained in a 30 second period when constant pressure was not required. Mean for two trials. (340·1)
71. Dynamometer sustained pull. *Total pull.* Lowest point to which the dynamometer was allowed to drop during a 15 second period. Mean for two trials. (341·1)
72. Dynamometer sustained pull. *Increase* in level of score 327, computed for each trial separately, of second over first trial. (341·6)
73. OR: Group organization (201·7)
(All OR's used in this matrix were made at the conclusion of the group meeting).
74. OR: Leadership technique. (202·7)
75. OR: Degree of leadership. (203·7)
76. OR: Orderliness. (204·7)
77. OR: Freedom of group atmosphere. (205·7)
78. OR: Degree of We-feeling. (206·7)
79. OR: Degree of frustration. (207·7)
80. OR: Degree of interdependence. (208·7)
81. Dynamometer sustained pull. *Optimism of aspiration.* (343b·321)
82. OR: Number of members judged to have shown leadership. (250·1)
83. OR: Number of members agreed upon as being principle leaders in at least one situation. (251·0)
84. Interest. *Decrease in variance* of the distribution of individual "investment" following group discussion of the two activities which the group ranked highest in preference. (062·2)
85. Interests: *Persistence of individuality.* The mean investment, following group discussion, by group members in the two choices ranked highest by the group less their investments in the same items *before* the group discussion. (064·1)
86. Interests: *Concentration of resources.* The extent available resources (votes) were concentrated in a single preference, or scattered over many. Measured by multiplying the rank assigned an item by the number of votes given it and summing for all items. (352·71)
87. Interests: *Inconsistency of decisions.* The extent that the rank of the number of votes given an alternative was inconsistent with the rank given the same alternative. Measured by subtracting the votes given each item from the votes given each item ranked higher, then summing all negative results. (352·72)
88. Discussion: *Rank of preference for Guessing Game.* (371d·4)
89. Discussion: *Rank of preference for Dynamometer.* (371e·4).
90. Discussion: *Rank of preference for Interests Situation.* (371f·4)
91. Discussion: *Rank of preference for Card Sorting.* (371g·4)
92. OR: *Motivation* to achieve the groups goal (not necessarily the goal set for the group by the experimenter). (209·7)
93. OR: *Extent group is concerned with procedure,* or of how it should be organized and how it should attack its problem. (213·71)
94. Random number

In spite of the attention given the problem in planning the experiment, it was possible to repeat performances under what appeared to be objectively similar circumstances for only a few of the syntality measurements in the

matrix. The estimates of reliability of the measures that were obtained are reported in *Table 2*. They were obtained by correlating the measure of

TABLE 2 *RELIABILITY OF GROUP MEASURES*

Variable Matrix No.	*Descriptive Title*	*Test-retest Reliability*
43	Guessing Game: Number of questions asked for "easy" item	·01
44	——: Number of questions for "difficult" item	·32
45	——: Rate of questioning	·19
46	——: Time to get answer to "easy" item	·03
47	Card Sorting: Number of stacks correct	·04
49	Discussion: Speed of ranking	·06
52	Construction: Planning time	·53
53	——: Decrease in planning time	·34
55	Group Judgment: Speed of reaching decisions	·24
56	Construction: Speed	·25
66	Attitudes: Quantity of change	·04
67	——: Decrease in variance	·18
70	Dynamometer, jerking pull: Total pull	·42
71	——, sustained pull: Total pull	·31
84	Interests: Decrease in variance	·25
87	——: Inconsistency of decisions	·08

TABLE 3 *THE ROTATED VECTOR MATRIX*

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	h^2
1	17	−07	−04	−04	51	37	−15	−07	11	16	23	−03	−03	−14	25	64
2	24	16	19	08	36	21	17	22	05	24	07	−05	16	11	05	48
3	47	21	−07	08	−01	−18	20	30	26	15	09	24	05	02	−07	60
4	30	51	08	−16	06	16	07	30	11	06	−28	38	02	−31	05	84
5	−07	26	−12	−03	21	06	04	05	60	−01	−22	17	06	07	02	59
6	−09	62	−04	−03	−19	−29	−07	−06	09	08	−25	−02	−03	−03	07	61
7	04	69	04	07	−09	−21	04	−04	36	−05	−08	22	−24	04	−03	79
8	−26	−11	30	−04	31	27	06	−13	02	−31	17	−02	01	08	−13	51
9	−85	20	00	−01	−06	−08	04	12	09	04	−04	−02	09	09	02	82
10	−01	−11	−24	10	−35	−01	−24	11	−10	01	57	02	15	01	29	71
11	05	48	−05	03	09	−02	−10	08	28	30	−01	04	−06	04	05	44
12	−46	−46	05	−11	−10	11	03	06	−24	12	01	11	10	−23	21	66
13	−09	22	−08	05	38	16	00	18	01	29	04	15	15	−19	07	44
14	−35	29	−09	06	−07	−01	−12	10	07	−07	−12	11	05	28	−06	37
15	03	63	01	−06	−10	−31	−01	10	−05	−06	−01	−11	−13	04	−09	56
16	−49	−41	00	06	07	13	13	01	06	09	−13	−04	04	−05	07	49
17	03	08	−27	02	28	16	−14	09	−10	03	19	14	30	10	28	46
18	−04	−08	−18	03	−06	12	−14	09	14	−36	−01	−28	02	15	07	34
19	02	−02	02	02	00	−12	06	00	−08	−02	−94	09	02	−38	−04	1·06
20	19	08	15	29	12	−06	−07	19	16	34	04	00	05	−08	31	46
21	00	06	02	13	50	30	17	−00	−10	12	−08	05	−23	16	−03	50
22	−26	16	−09	−10	45	−06	28	13	14	−06	−09	08	−10	−12	18	51
23	01	−04	−12	−02	40	−01	−14	11	−08	06	−10	−19	00	13	33	39
24	01	08	06	02	10	−03	−05	01	04	08	11	03	62	−12	11	46
25	−02	27	−18	03	28	07	06	−01	07	01	−06	−01	54	−00	−00	49
26	11	−01	−28	−21	−03	04	20	39	−10	−16	−10	28	47	−29	−03	76
27	−27	06	01	−32	09	02	03	34	03	08	−05	−08	30	−16	−05	44
28	06	−03	−09	05	−03	01	−20	11	−18	13	−11	19	11	−22	−18	26
29	−17	26	12	11	50	16	07	−10	07	15	00	−13	09	07	03	47
30	03	41	−16	05	22	15	06	−02	−03	10	08	07	−03	05	09	31
31	−20	21	06	13	−06	−34	10	−07	18	34	−10	−06	09	−12	10	43
32	−19	02	−05	26	−25	−28	20	28	−08	15	01	−01	03	−18	−00	43
33	−23	23	07	−12	13	−32	23	12	07	29	14	−04	−16	01	−11	46

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	h^2
34	−28	26	−05	−02	16	03	03	06	−09	−19	−02	−22	38	24	43	66
35	08	03	08	−04	18	08	41	14	18	−01	−03	−01	04	15	−13	31
36	15	−01	−08	−54	−10	−05	07	−24	09	−27	−06	−04	−23	04	−18	57
37	−18	−32	−05	35	15	06	06	09	−09	18	08	−06	08	13	02	35
38	14	43	17	−49	−14	06	−04	03	08	−31	22	−03	−10	02	10	67
39	11	03	−05	−59	03	−01	−00	−12	−17	18	07	10	−04	−05	01	46
40	02	40	27	−52	11	08	−12	05	−03	20	01	−07	−03	−06	−05	59
41	03	−04	05	−82	−02	−10	02	13	−04	00	−11	−05	−09	−08	00	74
42	−09	−05	−01	−70	−15	04	04	02	−09	07	−07	−00	08	16	15	60
43	−01	20	23	−07	05	−11	15	−29	−13	−32	04	−22	−09	−11	−08	42
44	−13	25	06	09	−03	−23	02	07	−15	−16	−07	−14	−15	−36	−34	49
45	−01	20	04	07	09	05	05	60	−20	−10	12	−03	−16	−01	−28	59
46	01	−00	02	−08	07	−00	05	−57	−08	−27	05	−10	00	−17	11	47
47	−11	12	02	02	08	01	01	03	07	76	08	−37	−01	16	06	79
48	−10	03	02	−10	−16	−02	−15	07	10	−43	04	02	04	12	14	31
49	−07	12	02	06	31	−04	−09	−03	04	06	−23	−22	41	02	03	41
50	−14	03	03	−07	05	−06	22	−01	−12	04	−18	−12	−27	−18	09	26
51	09	06	−59	04	12	04	−15	−06	−02	18	11	−18	−10	−05	11	51
52	03	12	−00	−02	−35	09	56	06	29	−03	−06	07	−09	−61	01	94
53	00	−03	−02	−03	00	53	04	09	−31	−17	−06	22	28	50	05	80
54	10	06	−00	−04	45	02	11	19	−06	−10	08	−29	02	−06	12	39
55	05	−03	−24	11	−04	−12	−00	−27	10	02	−00	−04	01	−47	−09	40
56	−24	13	−03	−08	−04	25	09	−10	−16	−12	16	−12	−02	34	28	44
57	02	−02	07	15	06	14	−07	−09	27	−16	−12	−08	11	−10	−05	21
58	05	−00	05	−02	02	78	−13	−11	08	04	08	−05	−03	04	−30	75
59	05	−12	02	08	−02	−80	−00	−06	08	−13	03	−11	06	06	08	72
60	−23	00	06	06	−40	−25	−02	−08	17	10	08	−11	−00	01	15	37
61	13	−13	10	11	−05	−73	05	07	09	06	−02	−04	−09	−20	−16	69
62	04	−08	05	−03	−10	−00	01	−00	04	−09	04	80	−02	07	−15	70
63	10	−65	12	01	−13	−04	−09	02	58	14	05	−25	02	17	−35	1·05
64	−29	−11	05	−21	11	−07	−04	−05	−33	24	−07	−31	−40	03	02	59
65	12	−10	−14	08	12	−09	03	30	−12	12	−18	21	07	16	04	30
66	18	14	00	−05	−03	15	−02	−12	−25	−09	15	29	22	−17	07	35
67	−01	−11	01	−12	−27	−19	−08	16	−13	−16	12	13	02	−01	−06	25
68	−08	03	05	−04	20	09	37	−16	−27	−09	13	−00	14	12	02	35
69	−04	−04	−36	−28	18	22	−01	08	−52	24	60	−04	08	09	−06	1·01
70	03	68	05	−31	33	07	00	43	−04	14	11	−00	−04	−28	40	1·13
71	40	02	−20	−32	10	01	03	06	57	−05	06	−34	−44	−04	07	96
72	19	21	−31	−02	−24	09	26	−08	−02	31	38	24	−32	−09	−02	73
73	42	02	−06	−02	08	−02	62	28	06	01	−01	−11	07	−09	10	69
74	28	05	−02	−03	05	21	−13	25	09	34	04	−10	01	06	07	35
75	63	−14	04	15	−02	06	63	09	−01	03	08	06	04	−06	03	87
76	53	−16	01	−09	15	27	17	07	11	08	−15	−08	23	−08	−07	56
77	08	24	−08	−00	−25	−05	46	43	−35	17	−04	40	−03	−05	13	87
78	50	07	−10	−06	19	−00	37	46	−14	16	−09	10	06	00	10	73
79	−53	17	−09	01	13	02	−24	−09	04	−45	04	−13	−19	00	−09	67
80	31	04	−08	−30	29	−03	20	36	08	−09	18	−19	02	28	03	61
81	07	11	−03	−34	09	02	42	−09	−14	−03	16	−21	19	−28	11	54
82	16	22	05	08	−23	−20	03	07	16	−29	28	09	−19	02	00	41
83	06	36	21	07	08	06	04	−10	09	−03	28	03	−21	12	−01	35
84	−09	01	00	−17	11	−05	−44	07	−04	−06	05	38	−09	−16	06	44
85	16	09	18	−03	35	−05	−54	−04	−15	−18	03	−05	16	−04	−12	59
86	02	−07	−87	03	−05	04	05	06	−07	02	−03	03	05	03	−01	78
87	−10	−05	−81	−04	07	−06	03	−06	16	−03	04	−03	−06	12	−03	73
88	02	06	09	09	−07	09	05	−09	−39	−00	−02	−13	−07	01	63	62
89	−13	61	07	06	11	33	37	04	−34	−34	−12	07	12	09	37	1·07
90	15	−08	05	04	−07	03	04	−07	04	29	05	−41	−08	09	−23	37
91	08	16	−43	−04	15	−04	−43	13	−20	−17	12	13	06	−29	12	65
92	46	14	−07	−11	17	−04	40	38	−07	02	16	12	−07	−00	11	65
93	25	27	07	28	−03	−06	90	15	−00	−04	−22	−16	−24	−12	−11	1·22
94	−16	01	01	−31	07	−08	15	09	05	−22	41	10	−27	−15	15	51
±·10 Hyper-plane	46	43	67	62	46	57	52	56	53	45	56	49	59	49	56	56%

performance in Session I with a similar measure of performance from a later session.

The correlation matrix obtained among the above 94 variables (the 94th is a random variable to test the standard error of a loading) was factor analyzed, using the Thurstone multiple group method, and stable communalities were obtained following four iterations. Fifteen factors were extracted. These factors were then rotated to yield the best possible simple structure. Following 18 overall rotations, involving each of the fifteen factors, and several additional rotations involving slight shifts in the position of individual factors, a reasonably clear simple structure was obtained. At this point the mean percentage of variables which were in the $\pm$ ·10 hyperplane, i.e., had correlations of not more than $\pm$ ·10 with the factors, was 56 per cent. This figure, showing in the last line of table 3, compares reasonably favorably with the 65 per cent frequently found in rotations of a varied set of personality variables.

The angles between the rotated factors are shown in *Table 4*.

TABLE 4 *ANGLES AMONG VECTORS*

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1														
2	−27													
3	04	16												
4	09	06	03											
5	12	−15	−10	−22										
6	00	−04	00	−01	06									
7	15	−04	07	13	−04	−05								
8	−03	05	−20	−29	03	−18	−03							
9	05	−05	05	−10	01	−17	00	−12						
10	08	−18	04	11	−05	−11	01	−06	−10					
11	−13	03	−12	−03	−10	01	−16	−05	−03	−07				
12	04	01	−10	01	−33	09	02	03	−11	−04	01			
13	00	−11	−08	−09	10	03	−04	11	−01	04	−04	00		
14	−17	−21	04	02	−01	18	03	−10	14	−04	03	−08	−03	
15	−12	16	−20	−05	20	−05	00	08	−12	03	14	−02	17	−14

5. THE FACTORS AND THEIR MEANINGS

We shall now state the factor patterns found with brief interpretative comments. As usual this will be done by listing the highest 10 per cent or so of the loadings (keeping clear of the lower limit of significance) and attempting to hypothesize what influence could be common to these manifestations. However, systematic hypothesizing and checking will not be attempted until the results for the second and third sessions are also published. The titles given the factors are temporary and aim at maximum *descriptiveness* in a few words.

Three characteristics combine in this factor: 1. Population personality

characteristics of adventure, vigor, dominance, purposefulness, orderly, willed application and freedom from anxiety (H, E, G, Q_3, N and O—).

FACTOR 1 *VIGOROUS UNQUESTIONED PURPOSEFULNESS vs. SELF-CONSCIOUS UNADAPTEDNESS*

Variable Matrix No.	*Descriptive Title**	*Factor Loading*
7	PTM Adventurous cyclothymia (H)	·69
70	*Dynamometer,* jerking pull: Total pull	·68
63	*Discussion:* Dislike for Group Judgment Situation*	—·65
15	PTM Deliberate Will Control (Q_3)	·63
6	PTM Positive Character Integration (G)	·62
89	*Discussion:* Preference for Dynamometer Situation	·61
4	PTM Dominance (E)	·51
11	PTM Polished Fastidiousness (N)	·48
12	PTM Calm trustfulness* (O)	—·46
38	SR Felt acceptance by other group members	·43
16	PTM Lack of nervous tension* (Q_4)	—·41
30	PTV Wide range of Independent self-sufficiency (Q_2)	·41
40	SR Commonness of purpose	·40
83	OR Many "principal" leaders	·36
37	SR Members do feel free to participate*	—·32

* The title shown here is not necessarily the same as that shown for the same variable in *Table 1.* In this and the following factor loading tables, the descriptive title will in all cases describe the performance of the group, with regard to the variable being measured, which goes along with the positive pole of the factor. Wherever this change in title has been made, it has been indicated by an asterisk (*). The sign of the correlation, however, has not been changed.

2. Self ratings in the group of feeling accepted and of working to a common goal. 3. High performance upon, and a liking for, coordinated vigorous action, with dislike for discussion and ill defined tasks ("Group Judgment").

FACTOR 2 *IMMEDIATE HIGH SYNERGY vs. LOW MOTIVATION*

Variable Matrix No.	*Descriptive Title*	*Factor Loading*
9	PTM Lack of paranoid suspiciousness* (L)	—·85
75	OR High degree of leadership	·63
76	OR High degree of group orderliness	·53
79	OR Low degree of frustration	—·53
78	OR High degree of we-feeling	·50
16	PTM Low amount of nervous tension* (Q_4)	—·49
3	PTM High level of emotional maturity (C)	·47
12	PTM Low level of worrying, suspicious anxiety* (O)	—·46
92	OR High level of motivation	·46
73	OR High degree of group organization	·42
71	*Dynamometer:* High score on sustained pull	·40
14	PTM Low level of independent self-sufficiency* (Q_2)	—·35
80	OR High degree of interdependence	·31

It resembles Factor V in the Wispe study (7) and, by total sense but not marker variables, the factor of "vigorous, self-willed order" in national culture patterns (2, 6).

The most likely explanation here would seem to be that the group performance and the feeling of acceptance in the group arise primarily from the interaction of personalities having these personality factors.

Essentially here we have a collection of observer ratings such as would be implied by our hypothesis of synergy. The group appears highly motivated, cohesive, and desirous of a high degree of leadership. "Maintained pull" is perhaps the performance which would be expected most directly to reflect simple high general motivation.

Again, however, the highest loadings are in population characters and on

FACTOR 3 *DEMOCRATIC, EXPLICIT PROCEDURE-ORIENTATION vs. HORDE URGENCY*

Variable Matrix No.	*Descriptive Title*	*Factor Loading*
93	OR Much concern with procedure	·90
75	OR High degree of leadership	·63
73	OR High degree of group organization	·62
52	*Construction:* Much time spent in planning	·56
85	*Interests:* Members show much persistence in individuality*	—·54
77	OR High degree of freedom of group atmosphere	·46
84	*Interests:* Low decrease in variance of individual investments about group preferences*	—·44
91	*Discussion:* Dislike for Card Sorting situation	—·43
81	*Dynamometer,* sustained pull: Optimism of aspiration	·42
35	SR Many members rated as making significant contributions	·41
92	OR High degree of motivation	·40
89	*Discussion:* High preference for Dynamometer Situation	·37
78	OR High degree of we-feeling	·37
68	*Dynamometer,* jerking pull: Much increase with practice	·37

general principles we would therefore expect these to be the "cause" of the associated group performances. Personality factors of warm-heartedness (L, freedom from paranoia), emotional maturity, and freedom from anxiety and nervous tension are here thrown together, possibly as a second order factor.

Our hypothesis will be that *in neonate groups the immediate determiner of the synergy level is the population personality level in freedom from paranoia, general emotionality, anxiety and tension.* It is interesting that the access of synergy shows itself so early not only in we-feeling and motivation but also in orderliness and the development of leadership.

This has several variables expressing one meaning of the term democratic: concern with procedure and planning, participation of several significant individuals, freedom of group atmosphere (observed, but not

significant in self ratings) and in preservation of individuality of opinions despite group discussion. The validity of the rating on procedure is shown by the loading of the actual measure of time spent planning. This emphasis on procedure seems related also to leadership and organization development, to optimism on dynamometer and to dislike of the exacting task of card sorting. These latter give it a slight resemblance to a former factor (7) of Easy verbal activity vs. Fortitude. At the negative pole is a marked "horde" pattern (3) wherein individuals change their opinions toward those of the group, show increase in homogeneity, and throw themselves into tasks with a sense of urgency and without preamble. The factor has only very slight relation to personality factors (C and M), and must be considered to arise largely from a group structural character of institutionalizing procedure, for this is loaded 0·9.

FACTOR 4 *SCHIZOTHYME RIGIDITY vs. CONFORMITY TO CIRCUMSTANCES*

Variable Matrix No.	*Descriptive Title*	*Factor Loading*
59	*Construction:* Not optimistic in aspiration*	—·80
58	*Construction:* Realistic in aspiration	·78
61	*Construction:* Low absolute level of aspiration*	—·73
53	*Construction:* Do most of planning before trial 1	·53
1	PTM Friendly cyclothymia (A)	·37
31	PTV Narrow range of Deliberate Will Control (Q_3)	—·34
89	*Discussion:* High preference for Dynamometer situation	·33
33	SR Wish to retain *few* of present members in future meetings:	—·32
15	PTM Low level of Deliberate Will Control (Q_3)	—·31

This factor is probably of less significance than its rank order indicates, because of spurious correlations among three construction-aspiration variables, which should fall lower in the factor. Its central feature is a schizoid high and unadaptable aspiration level (also in the dynamometer), with rigidity also in starting with little planning and in failing to reduce planning when it proves unprofitable. There is also evidence of low orderliness of procedure but satisfaction with co-workers. Since this factor has the highest loading of the population measure of schizothymia (A —) it may be that the whole pattern is to be ascribed to a summation of such personalities.

While the measures from the sociometric area tend to overshadow the others, this factor relates every panel of measurement in the present experiment. Because of this, we have rejected the possibility that it might be an artifact arising from some common response set, or treatment of the Likert type continua items used in the ratings, though such an artifact may have served to elevate these loadings.

The three items loading the factor highest have no other significant loadings in the entire matrix. What they seem to have in common is an

immediate enjoyment of the group life itself (though the sociometric ratings of actual individuals do not come here). That the ratings represent more than a subjective feeling, however, is attested by the observer rating of group interdependence and by the dynamometer performances which we have found before to be good indices of group motivation. There are slight personality associations with large scatter on both "Polished Fastidiousness" and dominance, which might mean less individual competitiveness than if the group were homogeneous.

FACTOR 5 *HIGH INTRINSIC SYNERGY vs. LOW INTRINSIC SYNERGY*

Variable Matrix No.	*Descriptive Title*	*Factor Loading*
41	SR High rated integration	·82
42	SR High satisfaction with overall efficiency	·70
39	SR High optimism for group's future performances	·57
36	SR High rated enjoyment of the group's activities	·54
40	SR Much commonness of purpose	·52
38	SR Members tended to feel accepted by the group	·49
37	SR Members *did not* feel free to participate*	—·35
81	*Dynamometer*, sustained pull: High optimism of aspiration	·34
27	PTV Wide range in Polished Fastidiousness (N)	·32
71	*Dynamometer*, sustained pull: High total score	·32
70	*Dynamometer*, jerking pull: High total score	·31
80	OR high degree of interdependence	·30

However, though we are dealing with a synergy level pattern, akin to that in factor 1, it seems difficult to ascribe it similarly to personality levels. It must arise from interrelations of persons which generate in some groups a higher level of gregarious satisfactions than exist in others. This source of synergy clearly corresponds to what we have called in our theoretical analysis (1) *intrinsic synergy*, i.e., that synergy which arises from the stimulus of social contacts themselves, and which has also been noted in group data by Hemphill (12).

The characteristics of this factor are a high mean in population intelligence, intellectual interest (possibly radicalism) and cyclothymia; a high scatter in as many as four other factors; a "good" performance in some group work, notably judgment and coordinated action on the dynamometer. Variable 60 in this context may indicate refusal to disregard reported norms in consequence of a single experience and 52 a quick resolution of problems of organization.

This factor has considerable resemblance to the largest in our earlier pilot study (7), there labelled *Intelligent "Esprit de corps"* or Morale I. There is the same propensity for intellectual problems, the same intelligent mutual understanding without time spent in discussion (coordination) and the same adapt-

ability, both in group aspiration (10) and the adjustment of individual interests to those reached in group discussion (85).

Our hypothesis then, which was that these characteristics might arise from a higher intelligence level in the population, is confirmed here to the extent that Personality Factor B is significantly loaded, as found in no other syntality factor. However, since the higher loadings are in *variances* the possible modification must be considered that this higher "group intelligence" arises not only from higher mean population intelligence and information but also from more varied group resources and better "role differentiation".

FACTOR 6 *INTELLIGENT ROLE INTERACTION vs. LOW MORALE I*

Variable Matrix No.	*Descriptive Title*	*Factor Loading*
1	PTM High Friendly Cyclothymia (A)	·51
21	PTV High Variance, Surgency (F)	·50
29	PTV High Variance, Radicalism (Q_1)	·50
22	PTV High Variance, Positive Character Integration (G)	·45
54	*Group Judgment:* High level of accuracy	·45
23	PTV High Variance, Adventurous Cyclothymia (H)	·40
60	*Construction:* Little difference between aspiration estimates*	—·40
12	PTM High level of Radicalism (Q_1)	·38
2	PTM High Level of Intelligence (B)	·36
52	*Construction:* Little planning*	—·35
85	*Interests:* Members show increased preference for the group's choices	·35
70	*Dynamometer,* jerking pull: High total score	·33

The group performances outstanding here are those which benefit through individuals acting on their own but with awareness of the needs of others and with conscientiousness. Their success comes not from warmth of immediate interaction but from group values in the individuals which cause them to act appropriately in isolation. Performances are unhurried, economical of words but effective. The members are rated as unfrustrated and satisfied with co-workers but they do not feel themselves as highly accepted, while the leadership procedures are democratic and permissive.

A similar factor, involving good guessing game performance, a similar dislike of physical performance, high interest in polished, esthetic activity, self criticisms, and insusceptibility to emotional appeal was found in the pilot study (7) and called "Friendly Urbanity, savoir faire vs. Lack of group self-possession". Some observers have wished to call the present factor "Laissez faire" vs. control of individuality. The present title is a compromise, intended to express a bipolarity between independent group respecting action, which is one essence of democracy, and some degree of regimentation required by lack of self possession. It remains for later research to investigate the relation of the two independent dimensions of democratic

organization found here—that opposed to urgency (Factor 3) and that opposed to control of individuality (Factor 7)—to the definition used by Lippitt (16) and Lewin and presumably combining these and other meanings of democracy.

FACTOR 7 *DEMOCRATIC "SAVOIR FAIRE" vs. LACK OF SELF POSSESSION*

Variable Matrix No.	*Descriptive Title*	*Factor Loading*
47	*Card sorting:* High number right	·76
79	OR Low degree of frustration	—·45
48	*Card sorting:* High rate of completion*	—·43
18	PTV Narrow range of Intelligence (B)	—·36
89	*Discussion:* Low preference for the dynamometer situation	—·34
74	OR Democratic type of leadership technique	·34
20	PTV Wide range of Dominance (E)	·34
31	PTV Wide range of Deliberate Will Control (Q_3)	·34
43	*Guessing Game:* Ask few questions for "easy" items*	—·32
38	SR Members do not feel accepted by the group	—·31
8	PTM Members tend to be Tender-minded, not Hard headed (I)	—·31
72	*Dynamometer* sustained pull: Show increased success with practice	·31
11	PTM High Level of Polished Fastidiousness (N)	·30

The origin of the present pattern can scarcely lie in population personality means, if the loadings of the latter should prove, even with other rotations, to be no higher than here. Yet it is striking that the group characteristics are just those one would expect to be associated with personality factors I− and N+.

FACTOR 8 *HIGH VERBAL INTERACTION*

Variable Matrix No.	*Descriptive Title*	*Factor Loading*
5	PTM High surgency (F)	·60
63	*Discussion:* Preference for Group Judgment	·58
71	*Dynamometer,* sustained pull: High total score	·57
69	*Dynamometer,* jerking pull: Not optimistic	—·52
88	*Discussion:* Low preference for Guessing Game*	—·39
7	PTM High level of Adventurous Cyclothymia (H)	·36
77	OR Not a free group atmosphere*	—·35

This is almost certainly a factor arising from a personality factor-surgency. The preferred activities are those involving talking and the high sustained rope pull might well also spring from the high "primitive passive sympathy" (3). It is noteworthy, in view of McDougall's theory of extrovert authoritarianism (17) that this factor contains a negative loading on freedom of group atmosphere.

Some raising of the top loadings has probably occurred here through

measures being derivative from a single situation. The high groups tend to perform the interest ranking quickly, to concentrate interest on a few

FACTOR 9 — *RECKLESSNESS*

Variable Matrix No.	*Descriptive Title*	*Factor Loading*
86	*Interests:* Group concentrates its resources (votes) on its highest preferences	—·87
87	*Interests:* Few inconsistencies in group decisions	—·81
51	*Interests:* Short time taken to cast votes*	—·59
91	*Discussion:* Low preference for Card Sorting*	—·43
69	*Dynamometer,* jerking pull: Not optimistic	—·36

alternatives only and to change little from the order assigned earlier. Together with the low optimism and the failure to improve on successive dynamometer pulls, as well as the high level of personality factor I, this suggests a kind of recklessness, but requires more variables to clarify.

This is a psychologically consistent pattern of behavior involving a slow rate of questioning, probably a result of the group's taking time to consider and formulate its questions, a quick arrival at the solution, high we-feeling,

FACTOR 10 — *GROUP ELATION vs. GROUP PHLEGM*

Variable Matrix No.	*Descriptive Title*	*Factor Loading*
45	*Guessing Game:* Slow rate of questioning	·60
46	*Guessing Game:* Short time taken to get "easy" answer*	—·57
78	OR High degree of we-feeling	·46
77	OR High freedom of group atmosphere	·43
70	*Dynamometer,* jerking pull: High total pull	·43
26	PTV Wide variance in Bohemian Symbolic Aggressiveness (M)	·39
92	OR High degree of motivation	·38
80	OR High degree of interdependence	·36

motivation, etc. It cannot be accounted for by any population characteristic present in the matrix. Our hypothesis is that it is a situationally engendered excitement or elation level.

Perhaps we may infer from this factor that when members are more

FACTOR 11 — *HOMOGENEITY OF EMOTIONAL MATURITY*

Variable Matrix No.	*Descriptive Title*	*Factor Loading*
19	PTV Uniform Emotional Maturity (C)	—·94
69	*Dynamometer,* jerking pull: Optimistic aspiration estimate	·60
94	Random number	·41
72	*Dynamometer,* sustained pull: Improvement with practice	·38

nearly of the same level of emotional maturity they tend to have more confidence in each other (as shown by higher aspiration in a real situation) and are able to learn better. At least it is evident that homogeneity of emotional maturity is an important independent dimension, though its full associations can scarcely be glimpsed with the limited related variables here.

Although loadings below ·40 can only be accepted as suggestive and not as of definite significance, we may include several in these last few factors of smallest variance in order to help our tentative interpretations of the total pattern. Here the high groups like construction, dislike attitude, interest and group judgment discussions, and are poor at performances requiring coordination. There is a suggestion of dominant individuals yet of tendency

FACTOR 12 *DISREGARD OF GROUP vs. ACCEPTANCE OF GROUP GOALS*

Variable Matrix No.	*Descriptive Title*	*Factor Loading*
62	*Discussion:* Preference for Construction Situation	·80
90	*Discussion:* Low preference for Interests Situation*	—·41
77	OR Free group atmosphere	·40
4	PTM Dominance (E)	·38
85	*Interests:* Members show increased preference for the group's choice	·38
47	*Card Sorting:* Few stacks correct*	—·37
71	*Dynamometer,* sustained pull: Low total score*	—·34
64	*Discussion:* Low preference for Attitude situation	—·31

to modify opinions toward the group. Experimenters with experience of many groups, high and low, are inclined to interpret this factor as an evasion of group life, associating the construction preference with impersonal activity, dawdling and horse-play (for which casualness the dominance may be a prerequisite)! It seems a condition in which the individual has not really accepted the group as a means to his ends, and has some similarity to the Withdrawal factor, No. 4, in the pilot study.

Here we find the existence of wide ranges of individual differences on the personality traits of tendermindedness, suspiciousness and Bohemianism

FACTOR 13 *FRUSTRATING TEMPERAMENTAL HETEROGENEITY vs. MORALE FROM HOMOGENEITY*

Variable Matrix No.	*Descriptive Title*	*Factor Loading*
24	PTV High variance in Tender-Minded Sensitivity (I)	·62
25	PTV High variance in Paranoid suspiciousness (L)	·54
26	PTV High variance in Bohemian symbolic aggressiveness (M)	·47
71	*Dynamometer,* sustained pull: Low score*	—·44
49	*Discussion:* Slow speed of ranking preferences	·41
64	*Discussion:* Low preference for Attitude situation	—·40
34	SR Many members rated as hindering the group's progress	·38

associated with poor performance on the sustained Dynamometer pull, pull learning thereon, taking a long time to reach decisions in the Discussion situation, a dislike of the Attitude situation and a reported feeling that many members hindered the group process.

The performance measures here seem fairly clearly to be consequences of the personality variances which load the factor. These may operate by making it difficult to achieve agreement either as to goals (the slow speed of ranking may be due to this) or as to how to achieve them.

The factor appears to be worthy of careful consideration on the part of those people concerned with assembling teams or work groups, such as small ship or air crews. Thus, grouping people who are alike, whether they are high or low on these three traits, could be expected to result in a reduction in the amount of "personality conflict", as well as in misunderstandings which result from the different perceptual systems associated with different ranges of these scales, and which lead to loss of effectiveness and to accidents. It may be worth pointing out that the fact that these are variance, rather than mean, scores would allow this kind of classification to be done with essentially no attrition.

This factor has little variance, but was recognized by participating observers as one of inhibition of verbal interaction presumably through the diffidence of low dominance and large variations in emotional maturity. Discussion activity lags, but manual activities are done quickly, though with little planning and somewhat poor results.

FACTOR 14 *DIFFIDENCE IN INTERNAL COMMUNICATIONS*

Variable Matrix No.	*Descriptive Title*	*Factor Loading*
52	*Construction:* Low amount of planning	—·61
53	*Construction:* Planning is done predominantly for first trial	·50
55	*Group Judgment:* Fast in reporting decisions	—·47
19	PTV Low variance in Emotional Maturity (C)	—·38
44	*Guessing Game:* Ask few questions in trying for "difficult" item	—·36
56	*Construction:* Slow rate	·34
4	PTM Low level of Dominance (E)	—·31

A fifteenth factor, loading liking for guessing game, the presence of many negative effectors and high H variance, also reached simple structure but had little variance left. It is interpreted by group observers as a factor of anarchy and disruptedness, but can be regarded only as a suggestive indication.

6. SUMMARY

1. A factor analysis of 93 population, structure and syntality variables measured on 80 neonate groups of 10 men each has revealed 15, some of

which are recognizably similar to factors indicated in the preliminary pilot study five years ago (7).

2. The striking general feature of these factor patterns is the high loading found in them for population personality variables. One may therefore contingently conclude that the syntality of formally leaderless groups, in their first three hours of existence, when exposed to the same, but very varied, demands, is primarily determined by the pre-group personalities of the component individuals.

3. Of the eight group dimensions in which population personality factors have highest or substantial loadings six are connected with high means—in personality dimensions A, B (Intelligence), F, H, I and L. Two are associated with high population variances (heterogeneity)—in factor C (Emotion stability vs. neuroticism) and the temperament factors I and L.

4. The nature of the *group* factors found with high *individual* personality factor means are entirely psychologically consistent with what is known about these personality factors. For example, high L (Paranoid) powerfully reduces the immediately available group synergy, while high F (Surgency) produces high verbal interaction and group contagion of emotion.

5. The independent dimensions of group variation not associated with population differences can only arise from small, accidental, unintended differences of group experience which have the peculiarity of exaggerating themselves by a feedback mechanism or which for some reason produce, directly, relatively large results. The Group Elation factor may be of the latter kind, as a success-failure consequence. The level of Intrinsic Synergy, and of Acceptance of Group Goals can be envisaged as generated by the former mechanism, through cumulative effects of initial faint attitudes.

It is difficult, however, without further examination of the data, to suggest hypotheses for the generation of the two democracy dimensions. A possibility is that to subjects in different economic circumstances the $100 reward represented different levels of urgency and so differentially reduced, in some groups, the toleration of punctilio in procedure. Such background "situational" differences, not embodied in personality, have not yet been investigated.

6. Some of the syntality factors loaded in population measures present significant correlations among personality factors. It remains to be investigated whether these are (as they could be) the same as the second-order factors found in *individual* psychological research on personality factors, or how far they illustrate the theoretically interesting possibility that certain *combinations* of personality factors in a group uniquely generate group "emergents". For example, the combination (in Factor 13) of high variance in the neurosis-associated I factor with the paranoid L factor can readily be imagined to produce the observed morale-destroying effects in a way not likely from either alone.

7. The concepts of synergy and maintenance synergy, as important

dimensions of syntality, are borne out by this analysis, in that cohesion ("we-feeling"), strength of motivation, optimism of aspiration and goodness of performance on non-complex but exhausting tests are shown to go together. However, this synergy pattern is shown to arise from more than one cause. Fuller discussion of dynamic hypotheses regarding these factors is best deferred, however, until further research, now in progress, has confirmed and sharpened the patterns.

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BIBLIOGRAPHY

1. CATTELL, R. B. "Concepts and methods in the measurement of group syntality", *Psychol. Rev.*, 1948, *55*, 48–63.
2. CATTELL, R. B. "The dimensions of culture patterns by factorization of national characters", *J. Abnorm. & Soc. Psychol.*, 1949, *44*, 443–469.
3. CATTELL, R. B. *Personality: A Systematic Theoretical and Factual Study*. New York: McGraw Hill, 1950.
4. CATTELL, R. B. "New concepts for measuring leadership, in terms of group syntality", *Hum. Rel.*, 1951, 4, 161–184.
5. CATTELL, R. B. *Factor Analysis for Social Science*. New York: Harper Bros., 1952.
6. CATTELL, R. B. "An attempt at more refined definition of the cultural dimensions of syntality in modern nations", *Amer. Sociol. Rev.*, 1952.
7. CATTELL, R. B., and WISPE, L. G. "The dimensions of syntality in small groups", *J. Soc. Psychol.*, 1948, *28*, 57–78.
8. CATTELL, R. B., SAUNDERS, D. R., and STICE, G. "The 16 Personality Factor Questionnaire. Champaign, Ill.: Instit. Personal. and Ability Tests. 1950.
9. CATTELL, R. B., and MEELAND, T. Standardization and Social Validation of the 16PF Test on Occupational and Clinical Groups. (In Press.)
10. FESTINGER, L. "Informal Communications in Small Groups", *Groups, Leadership and Men*, edited by H. Guetzkow. Pittsburgh: Carnegie Press, 1951.
11. GIBB, C. A. "The Emergence of Leadership in Small Temporary Groups of Men." Ph.D. Thesis, Univ. of Illinois Library, 1949.
12. HEMPHILL, J. K. "Situational Factors in Leadership", *Bur. Educ. Res. Monogr.*, 1949, No. 31. Columbus: Ohio State Univ.
13. HEMPHILL, J. K. "The measurement of group dimensions", *J. Psychol.*, 1950, *29*, 325–342.
14. HOFSTAETTER, P. R. "A factorial study of culture patterns in the U.S.", *J. of Psychol.*, 1951, *32*, 99–113.

15. JAMES, J. "A preliminary study of the size determinant in small group interaction", *Amer. Sociol. Rev.*, 1951, *16*, 474–477.
16. LIPPITT, R. "Field theory and experiment in social psychology: autocratic and democratic group atmospheres", *Amer. J. Sociol.*, 1939, *45*, 26–49.
17. MCDOUGALL, W. *National Welfare and National Decay*, New York: Methuen, 1921.
18. THORNDIKE, R. L. "Individual Differences", *Annual Review of Psychology*, 1950, *1*, 87–104.
19. THURSTONE, L. L., and CHAVE, E. J. *Attitude Scales*, Chicago: Univ. of Chicago Press, 1929.

BIOGRAPHICAL NOTE

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A CONSIDERATION OF INDUSTRIAL ACCIDENTS AS A MEANS OF WITHDRAWAL FROM THE WORK SITUATION

A Study of their Relation to Other Absences in an Iron and Steel Works

J. M. M. HILL and E. L. TRIST

I. THE NATURE OF THE PROBLEM

The Origin of the Inquiry

One of the points noted by the Iron and Steel Productivity Team which visited the U.S.A. in 1951 was the discrepancy between American and British accident rates. While there were differences in methods of compiling the figures, there was nevertheless sufficient evidence of a real difference in the level of accidents to cause concern. The American lost time accident frequency rate per million man-hours worked for the year 1949 was reported as 7·2, whereas the British equivalent was 32·6 (3). As a result, the British Iron and Steel Research Association initiated a study of accidents in the British industry through its Operational Research Team, with the first author as the responsible officer. He, at a later stage, invited the collaboration of the Tavistock Institute, represented by the second author, when a further analysis of the findings appeared necessary after a preliminary report had been made.[1]

At the beginning of the investigation a survey was made of available research, several firms were visited and a number of Safety Officers consulted. These preliminaries showed that in spite of the considerable reduction made over the last few decades it was widely acknowledged that the level

1. "British Iron and Steel Research Association Accident Research, An Account of Work in Progress", J. M. M. Hill. List No. 54 (Restricted). June, 1953. Miss Monica Brothers of the British Iron and Steel Research Association assisted with the preliminary analysis and tabulation.

of accidents in the British industry was too high and could be further reduced if appropriate methods could be found.

The Need for a Social Approach

The level of accidents sustained in any working organization has been held to depend on the interaction of two major groups of factors. On the one hand are what may be called the "opportunities" for accidents—the actual risks and hazards of the job; on the other, the propensities of individuals to take these opportunities, i.e., to have accidents. Current remedies tend to concentrate either on blocking up the opportunities for accidents in the physical environment (e.g., by guarding machinery or prohibiting access to certain areas) or on attempting to reduce the propensity of the individual employee to take these opportunities (e.g., by accident propaganda and campaigns of various kinds or by selection and training).

With regard to the former, while much useful work has been and is being done, a consensus of opinion appears to be coming into existence which agrees that there is a definite limit to the reduction which can be achieved by such means as guarding. One Inspector of Factories recorded the view that no more than a ten percent reduction can be hoped for from such means. With regard to the second aspect, industry still relies mainly on various types of accident propaganda which are both rationalistic and moralistic in tone. Yet many of the people carrying special responsibility for accident prevention have acquired intuitively the knowledge that accidents are in fact often motivated by unconscious trends in the individual or may be indirect consequences of tensions between groups. It is a common experience that the results of anti-accident campaigns are apt to be disappointing. Too often, positive effects are short-lived, and sometimes the outcome is negative.

Within psychology, the traditional approach has been to consider the personal characteristics of those exposed to accident risks. This has led to the concept of "accident proneness". Accident proneness may be looked at in two ways, the first of which depends on demonstrating that the equal exposure of a certain number of individuals to a given risk results in their sustaining an internal distribution of accidents inconsistent with pure chance. But in practice it is never possible to find conditions of absolutely equal exposure, and it is difficult to approach sufficiently closely to such conditions in most available settings to make much practical use of attempts to locate and re-direct the highly accident prone among the members of a particular organization.

Furthermore, the calculation of the hypothetical chance distribution can only be based on the number of accidents actually sustained, without reference to whether the mean level is itself due to characteristics of the group. It can only be said that such-and-such individuals have more accidents than would be expected on the basis of a pure chance distribution calculated from the mean. The value of the mean itself cannot be commented on in this way, so

that in a group of people all highly, but equally, susceptible to accidents no-one would be distinguished as accident prone.

The second way of looking at accident proneness is to ask in what respects do those individuals sustaining accidents differ from their fellows. This method generally consists in taking a group of employees who have had accidents and comparing them by means of psychological tests with an accident free control group who are as alike as possible in terms of certain criteria. Some extremely interesting results have been obtained with this approach, especially when the personalities of those sustaining accidents have been investigated by more detailed psychiatric and psycho-analytic techniques (1). But formal tests can at present only predict those liable to accidents within broad limits so that their usefulness as an instrument of selection is limited. Moreover, they take no account of the growing body of evidence which suggests that the behaviour and reactions of individuals cannot be adequately interpreted by reference to themselves alone. Account must be taken also of their relation to a cultural as well as to a physical environment, which, in the case of a place of work, is a highly organized structure—both technically and socially.

It was felt therefore that the approach adopted should not be confined to the study of accidents as events belonging to the industrial environment in the physical sense or to accident proneness as a characteristic of the personality of the individual. Rather it should be widened to take into account the social aspects of the relationship of people to their work. That is to say that accidents require study within the broad context of the process of occupational adjustment in a work organization. Accidents are social as well as personal events, and, in industry, happen by virtue of the fact that the people concerned are members of some kind of work organization. It would seem to follow that the quality of the relationship obtaining between employees and their place of work would in some way come into the question of accidents.

The Withdrawal Hypothesis

In adopting such an approach for the purpose of the present study it has been borne in mind that previous work has indicated that the occurrence of accidents may be frequently (though not necessarily always) related to the personal characteristics of those sustaining them, and that as a result accidents may be consciously or unconsciously motivated by the individuals concerned. Characteristically, industrial accidents cause both injury and absence from work, and, so far as they are motivated events, the motivation (however unconscious) may be directed towards either of these ends. In this paper concern will be with the absence effects. Accidents will be considered as a means of withdrawal from the work situation through which the individual may take up the role of absentee in a way acceptable both to himself and to his employing organization.

So far as industrial accidents are a motivated form of withdrawal from the work situation the likelihood arises of their being associated with other such forms of withdrawal. For examination, therefore, is their relationship with such phenomena as labour turnover, sickness, and "voluntary" forms of absence.

II. METHODS

The Intensive Study in One Firm

The complexity of the factors involved, and the uniqueness of their combination in any particular work situation, involves as a first step such an examination taking place in one firm. The firm chosen should, it was felt, be a relatively large unit in order to provide sufficient numbers. To be representative, it should also contain within itself the main processes basic to iron and steel production—at a level providing a good working example of the industry under present British conditions. It was further desirable that the firm should have a well-established and stable industrial "culture" and a traditional source of labour, since these would increase the "background" constancies required. Essential qualifications were the possession of sufficiently detailed records, and a willingness to provide the extensive co-operation that would be required.

A firm of the type required was found in the Park Gate Iron and Steel Company Limited, of Rotherham, near Sheffield, which employs upwards of 3,500 people, drawn from the near neighbourhood in a traditional steel-making area.

Very full records are kept by the firm over a wide range of personnel matters and these were made available.[2]

Following-Up an Entrant Group

If accidents are to be studied from the point of view of a man's relationship to his place of work it becomes necessary to study this relationship from the time he first starts work in the firm. The procedure used—of fixing a base period during which all those entering the firm are regarded as constituting an entrant group whose subsequent careers are then followed up over a predetermined number of years—has been described elsewhere in regard to studies of labour turnover.[3] As will be indicated below, the labour turnover of the entrant group has an important bearing on the study of the accidents which its members sustain.

The year 1947 was made the base year and the 831 individuals who entered Park Gate during this period were followed up in the records of the

2. Permission to publish the results reported has been given by the Company, who gave great help in the extraction of the data.

3. These have appeared in *Human Relations*, 1950, Vol. III, No. 4; 1951, Vol. IV, No. 3; 1951, Vol. IV, No. 4; 1952, Vol. V, No. 1; 1952, Vol. V, No. 4; 1953, Vol. VI, No. 1. The present authors contributed to the series in collaboration with A. K. Rice, who has recently summarized this work (4).

firm over a four-year period with 1951 as the terminal year. The detailed information which the type of records kept made available is described in Appendix I. This was collected for each man, and made possible the examination of a number of topics, on most of which some preliminary work has been done in addition to that with which the present paper is concerned.

This particular follow-up period was determined in collaboration with the firm as being a time during the whole of which the very full personnel records available had been kept according to rigorously consistent procedures by the same group of people in the Personnel Department working together on an agreed basis. Also the overall accident rate for the firm as a whole remained constant (though with the usual fluctuations) at about 5 accidents per 100,000 man-hours worked. Though this rate fell slightly for the last six months of the period, this fall could have had no more than a very small effect on the 1947 entrant group and that only at the extreme end of the period.

The Relevance of Labour Turnover

Conventional industrial accident rates ignore labour turnover; accidents occurring within a firm being recorded without regard to the length of service of the individuals who sustain them. But if accidents are to be studied as a function of the person-work relationship, the quality of this relationship must be taken into account. An important aspect of this is length of service.

TABLE I *DISTRIBUTION OF LENGTHS OF SERVICE OF 1947 ENTRANTS*

Length of Service (Weeks)	*Half-Yearly Period*	*Numbers Leaving*	*Percentage Leaving*	*Percentage Remaining*
0– 25	1	291	35·0	65·0
26– 51	2	77	9·2	55·7
52– 77	3	46	5·6	50·2
78–103	4	46	5·6	44·6
104–129	5	33	4·0	40·7
130–155	6	15	1·8	38·8
156–181	7	16	1·9	36·9
182–207	8	18	2·2	34·8
Over 207	Over 8	(289)	(34·8)	(34·8)

Total Entrants: 831.

In order to obtain a measure of the change in composition of the entrant group a record was made of individual lengths of survival of all entrants to Park Gate in 1947, according to the method described in the earlier work on labour turnover. In *Table I* are shown the numbers and percentages who left and who survived in their first, second, and third half-year's service, etc. The initial rate of leaving is high, 35 percent of employees leaving before completing a full half-year. About 10 percent leave in their second

half-year. Thereafter the proportion leaving declines rapidly. Work in other industries has shown that the curve that may be fitted to such a distribution, which in all cases so far studied has been J-shaped, can be related to certain basic characteristics of the firm in which it occurs, and is unlikely to change radically unless these change also.[4]

The survival distribution is important to accident studies for four main reasons:

1. It gives a general picture of the lengths of exposure to risk of individuals in the sample entrant group, which is necessary if their accident records are to be compared.
2. By indicating the initial high rate of leaving, it gives an idea of the effect which some forms of action might have. A large part of the effect of an initial propaganda campaign will be wasted if a considerable proportion of those to whom it is directed leave after only a few weeks.
3. It gives a measure of the progressive acclimatization of entrants. On coming to a firm entrants are in new surroundings. Many find it difficult to adjust and a large proportion leave. As time goes on and early difficulties are weathered, there is a progressive decline in the rate of leaving. It is recognized that the way a man fits his job may affect his liability to sustain accidents. But when he joins a firm he does more than learn a technical skill: he becomes a member of a social group. If he cannot fit in, the results may be just as serious as if he cannot do his job from a technical point of view.
4. These difficulties of adjustment are not felt only by those entrants who leave. They are felt also to some degree by those who stay. It is in relation to staying on that absences, as distinct from leavings, may be seen to have special importance.

This last point will now be examined in more detail.

The Importance of the Stabilized Group of Stayers

The study of survival distributions has suggested that the process of labour turnover has three broadly distinct phases: an *induction crisis* when a large proportion of entrants become casualties as a result of their initial encounter with the firm; a period of *differential transit* when those who survive learn the ways of the firm and discover how far they have a place in it; and a period of *settled connection* characterized by a remainder of quasi-permanent employees. By this time leaving has become intermittent, with little tendency either to increase or decrease. The survival distribution "tails off", its extent limited, theoretically, only by the span of life.

4. A note on labour turnover at Park Gate in relation to these characteristics has already been published, which gives the distribution of the total entrant group over the forty-four internal departments and the numbers of long-service survivors in each, and suggests some of the reasons which tend to make a high rate of initial leaving go together with a high rate of eventual survival into long service (2).

In the 1947 group at Park Gate the induction crisis occurs within the first half-yearly period, the phase of differential transit is spread over the next four, and during the last three conditions of settled connection are approached. There is reason, therefore, to consider the 289 "stayers" still remaining after four years' service as a quasi-permanent remainder. Such a stayers' group may be described as a stabilized working population exposed to the risk of accidents in the same overall social and technical environment over a period of time long enough to allow completion of the main phases of occupational adjustment.

Though leavings and absences may both provide means of withdrawal from the work situation, absences are nevertheless the obverse of labour turnover. In contrast to leaving one place of work for another, they represent being away from the job while still remaining with the same employing institution. In terms of the relationship between the individual and his work organization, they indicate disturbances in a continuing relationship, whereas leavings are a sign that the relationship has been broken. On this assumption one might expect certain changes in the preferred modes of withdrawal at different stages of service. During the phase of differential transit absences might well go up as labour turnover declines, while in the phase of settled connection there might be changes both in the overall level of absence and in the forms to which recourse is most commonly made. In this way two dimensions can be distinguished in the present inquiry:

1. So far as accidents are motivated forms of withdrawal, one might expect them to be associated with other forms throughout the four years' service of the quasi-permanent remainder, this period being taken as a whole.
2. Changes in the degree or form of withdrawal may be expected to occur within this period, arising from the changing relationship, as time goes on, of the entrant group to the organization.

In the present paper the first of these two aspects will be examined, the second being reserved for a subsequent report. The importance of the stayers' group is (*a*) that they have all been exposed to risk and stress in the same work organization, (*b*) that they have all experienced the common problem of working out adjustment to a quasi-permanent relationship with this same organization over the same four-year period. By screening out the leavers the effects of labour turnover have, as it were, been held constant.

The group will be treated as a whole, differentiation to the level of departments being carried out only when ambiguities arise in the meaning to be attached to particular results. The modal age of the group at entry was within the 21–30 age range. It is virtually an all-male population. Though the range of skill is considerable, it is on the whole weighted towards the more highly skilled. Internal group differences of this kind, however, are not considered relevant to the level of analysis attempted.

III. ABSENCE AND ACCIDENT CHARACTERISTICS

Total Absences

The distribution of total absences per individual occurring among the 289 individuals of the stayers' group in their first four years of service is given in *Table II.*

TABLE II *NUMBER OF ABSENCES PER MAN*

Absences	*Individuals*	*Absences*	*Individuals*
0– 4	41	50–54	9
5– 9	65	55–59	2
10–14	46	60–64	3
15–19	39	65–69	–
20–24	26	70–74	1
25–29	22	75–79	–
30–34	9	80–84	1
35–39	12	85–89	–
40–44	5	90–94	1
45–49	6	95–99	1

Total Individuals: 289
Total Absences: 5,302

Inspection shows a pronounced mode with considerable positive skewness. This suggests the existence of some kind of a norm as regards absence behaviour to which a large proportion of the individuals concerned conform, the rest deviating from this norm in varying degrees. A certain number of absences are the rule, between 5 and 15 over the four-year period being the most usual. Only a minority have more than 20; those with more than 30, or more than 50, become progressively smaller numbers, though the occasional individual is to be found, even in a stabilized group of this kind, who has been away more than 80 or 90 times.

A first indication of the nature of this norm as a specifically social phenomenon is obtained when the time lost as a result of these absences is considered. The total time lost was 16,954 days, distributed as shown in *Table III.*

This distribution is unimodal, markedly J-shaped and has a relatively long "tail". The great majority of absences (over 73 percent) are of a "one day off" character. This is the dominant convention in absence behaviour taken as a whole.

The Forms of Absence

The next step is to consider the various categories of absence recorded by the firm. Absences due to some form of physical inability are recorded at Park Gate under three headings, which are self-explanatory: *accidents, certified sickness,* and *uncertified sickness.* "Able-bodied" absences are also recorded

so that it was possible to separate three groups for research purposes: those for which *permission* has been sought and granted beforehand; those for which a *sufficient reason* has been given by the man on his return to work;

TABLE III *NUMBER OF DAYS LOST PER ABSENCE*

Number of Days Lost	*Number of Absences*	*Number of Days Lost*	*Number of Absences*
1	3,894	41–45	7
2	516	46–50	10
3	137	51–55	3
4	78	56–60	5
5	63	61–65	2
		66–70	2
1– 5	4,688	71–75	3
6–10	263	76–80	1
11–15	146	81–85	–
16–20	71	86–90	4
21–25	42	91–95	1
26–30	24	96–100	–
31–35	15	Over 100	7
36–40	8		

Total: 5,302

and those for which *no reason* of an acceptable kind has been given. It is these last that constitute "voluntary absenteeism" in the conventional sense, though this is not always so strictly defined.

In *Table IV* the distribution of these various forms of absence, including

TABLE IV *FORMS OF ABSENCE (FREQUENCY, TOTAL TIME LOST, MEAN TIME AWAY)*

Form	*No. of Absences*	*Percent of All Absences*	*No. of Days Lost*	*Percent of All Days Lost*	*Mean Days Lost per Absence*
Accidents	124	2·3	2,476	14·6	20·0
Certified Sickness	658	12·4	8,805	51·9	13·4
Uncertified Sickness	746	14·1	1,061	6·3	1·4
Permission	119	2·2	182	1·1	1·5
Sufficient Reason	835	15·8	1,180	7·0	1·4
No Reason	2,820	53·2	3,251	19·2	1·2
Total	5,302	100·0	16,954	100·1	3·2

accidents, is given with respect to frequency, total number of days lost, and mean days lost per absence. Accidents, like absence with permission, are relatively rare forms of absence, accounting for only some 2 percent of the

total incidence. Certified and uncertified sickness and sufficient reason account for approximately 15 percent each, whereas no reason absences ("absenteeism") constitute more than 50 percent of the total even in this long-service group. On the other hand, somewhat more than 50 percent of the total time lost is attributable to certified sickness. Accidents here appear after no reason absences as the third most important contributors to lost time. None of the other forms contribute appreciably. With regard to mean time lost per absence, accidents now head the list (three weeks as compared with a fortnight for certified sickness, though the mode for accidents is within the first week and in the second for the latter). Other forms conform to the "day off" pattern.

The dominant pattern, of taking the day off, is attributable to the three able-bodied forms together with uncertified sickness. These, being alike in this respect, contribute to time lost in proportion to their relative frequency, which, however, varies widely. Accidents and certified sickness follow a different pattern as regards mean time away—that of being off between a week and three weeks. They differ from each other in that accidents are among the most infrequent forms of absence while certified sickness is moderately frequent. Between them they account for approximately two-thirds of the total time lost.

The above descriptive analysis suggests that the interrelations between the various forms of absence are likely to be complex. But there is enough evidence of patterning to indicate the probability that relationships exist. The key variables are frequency and time away. Forces may be presumed to exist in the total situation which result in widely different degrees of recourse being made to the various forms of absence, while producing two quite distinct time-scales (the day off and the one–three weeks away). What is commonly thought of as "absenteeism" belongs to the first time scale, to which, however, a number of other forms, including uncertified sickness, also conform. What is commonly thought of as "sickness" belongs to the second time scale and includes accidents as well as certified sickness. As regards the order of this time scale, the fact that one, two, or three weeks away cover the vast majority of the cases is an indication that most of the accidents sustained, as of the illnesses suffered, are not of a particularly serious character.

The Accidents

In fact, just as common maladies make up most of the illnesses, so do most of the accidents fall within the class of everyday mishaps. In all, 124 lost time accidents, i.e., accidents causing the loss of at least one shift and therefore occasioning absence [5] were sustained over the four-year period by

5. Accidents not causing the loss of at least one shift, so-called "minor accidents", are excluded from the present study. In the first place they do not produce absences; in the second they are notoriously affected by the differing propensity among individuals to report.

the 289 individuals in the stayers group. The nature of these mishaps and the type of injuries sustained are given in *Tables V* and *VI* according to the conventional industrial classifications.

TABLE V *TYPES OF MISHAP*

Type	*Number*
Handling Objects	27
Hit by Falling Objects	25
Falls of Employees	24
Stepping on or Striking Objects	22
Hand Tools	8
Burns	7
Vehicles	3
Machinery	2
Occupational Disease	2
Miscellaneous	4
Total	124

TABLE VI *NATURE OF INJURIES SUSTAINED*

Nature	*Number*
Bruise	33
Sprain	28
Cut	17
Burn	11
Trap	7
Foreign Body	6
Multiple	5
Fracture	4
Occupational Disease	3
Gas	2
Shock	2
Dislocation	2
Amputation	1
Sepsis	1
Crush	1
Hernia	1
Total	124

As regards type of mishap, four common classes dominate the scene and account for 76 percent of the accidents: handling objects; being hit by falling objects; falls of employees; stepping on or striking objects. In contrast, there

TABLE VII *NUMBER OF DAYS LOST PER ACCIDENT*

Number of Days Lost	*Number of Accidents*	*Number of Days Lost*	*Number of Accidents*
1–5	29	51–55	2
6–10	24	56–60	2
11–15	16	61–65	1
16–20	14	66–70	2
21–25	13	71–75	–
26–30	8	76–80	1
31–35	4	81–85	–
36–40	1	86–90	1
41–45	1	Over 90	2
46–50	3	Total	124

are only 7 burns, despite the quantity of hot and molten metal in the vicinity; only 3 mishaps attributable to vehicles, despite the amount of traffic continually engaged in moving heavy material about the works; and only 2 mishaps attributable to machinery, despite the amount of machinery present, especially in the rolling mills. Moreover, the injuries are mostly superficial: bruises, sprains, cuts, and burns (which here include blisters) account for over 70 percent of the total.

In *Table VII* the number of days lost per accident is given. Though, as mentioned earlier, the mean is 20 days, the distribution is J-shaped, and approximately 70 percent of the absences are less than three weeks. The prevailing accident pattern may be summed up as consisting of common mishaps causing superficial injuries leading to relatively short absences.

The 124 accidents sustained were distributed among the 289 individuals as shown in *Table VIII*, 89 people being involved.

TABLE VIII *NUMBER OF ACCIDENTS PER MAN*

Number of Accidents	*Number of Individuals*	*Poisson Series*
0	200	188·19
1	64	80·54
2	17	17·42
3	6	2·54
4	2	·28
Over 4	–	·03
Total	289	289·00

Only 8 sustained more than 2 accidents over this four-year period. Values for the Poisson Series are given as a matter of interest. Application of the accident proneness concept to redirect these few "accident repeaters" could have little meaning in the present context, especially in view of the variety of occupations performed. In what follows those sustaining accidents will be treated as a total group and contrasted with the accident-free remainder first in relation to absence behaviour as a whole and then in relation to particular forms of absence.

IV. ACCIDENTS IN RELATION TO THE ABSENCE PATTERN AS A WHOLE

The Differentiation of Accidents from Other Absences

In field theory terms the occurrence of absences in general may be regarded as the result of the interaction of individuals with their work situation plus a certain amount of interference from events occurring in the rest

of their life space. A first subdivision would be to distinguish between absences according to where in the life space the events occur which are their immediate sources. Industrial accidents are by definition sources of absence arising from events occurring in that part of the life space comprised by the person-work relationship. Other forms may arise immediately from events occurring in any other part of the life space.

The Specific Hypothesis to be Tested regarding Accidents and Other Absences

Within that part of the life space comprising the person-work relationship, it has been assumed (as stated on page 359) that while some of the accidents may arise from the working environment entirely, others may be partly or wholly motivated (however unconsciously) by the person himself. It has been further postulated that so far as accidents are motivated forms of absence, there is a likelihood that they will be positively associated with other forms of absence behaviour leading to temporary withdrawal from the work situation.

The group of individuals under consideration sustained a total of 124 accidents (involving a loss of 2,476 days' work) and 5,178 other absences (involving a loss of 14,478 days' work). Though accidents accounted for 15 percent of all time lost, with a mean time away of 20 days per accident, nevertheless, in terms of incidence, they only accounted for some 2 percent of all absences.

They were not a form to which frequent recourse was made—only permission absences had a similar low frequency. If an individual did go absent he usually tended to do so by some form of absence other than an industrial accident. Only 4 out of the total 289 individuals did not go absent at all during the period under consideration whereas 200 remained accident-free. An exclusive "preference" for accidents as a form of absence would seem to be unlikely.

It follows that if an individual in a given situation has a high propensity to go absent, it is unlikely that the substitution of an accident for another form of absence will reduce by very much the extent to which he will resort to this other, and usually much more common, form. But—and here is the crux of the matter—if accidents do occur as a result of a high propensity to go absent, they will tend to be associated with a high absence rate. In other words, those having accidents will tend to have more other absences than the rest and will tend to fall within the group of deviates with absence records above the social norm shown in *Table I.*

Overall Comparison of the Accident Sustaining and Accident Free Groups

In order to test this hypothesis accidents will be separated from other absences and the distribution of other absence divided into two parts, namely, those attributable to individuals having accidents and those attributable to

individuals remaining accident free. The symbols *A+* and *Ao* respectively will be used to designate these two groups. Results are given in *Table IX.*

Examination of the two distributions reveals the difference in absence behaviour expected by the hypothesis. The values of both the mean and the

TABLE IX *NUMBER OF OTHER ABSENCES PER MAN AMONG THOSE WHO DID NOT HAVE ACCIDENTS (Ao) AND THOSE WHO DID (A+)*

Absences	*Ao*	*A+*	*Absences*	*Ao*	*A+*
0–4	38	6	50–54	3	3
5–9	52	11	55–59	1	2
10–14	36	15	60–64	2	–
15–19	23	14	65–69	–	–
20–24	16	7	70–74	–	1
25–29	12	10	75–79	–	–
30–34	3	5	80–84	1	–
35–39	6	6	85–89	–	–
40–44	4	2	90–94	–	1
45–49	3	5	95–99	–	1

Total Individuals: *Ao* = 200 *A+* = 89
Total Absences: *Ao* = 3006 *A+* = 2172
Mean Absences per Individual: *Ao* = 15·03 *A+* = 24·40

mode are greater for the *A+* than for the *Ao* group and a comparison of the two distributions by χ^2 gives a significant value of 25·86 with six degrees of freedom. Those individuals, therefore, who had accidents showed a greater tendency to go absent by other forms than those who remained accident free.

The Departmental Factor

Although the data are consistent with the hypothesis advanced, another explanation has not yet been ruled out—namely, that in those departments where most accidents occur (the most dangerous) most absences will also occur, both these phenomena resulting from a *common* individual reaction to *different* work situations. If, however, it can be shown (even should this to some extent be the case) that the association established between accidents and other absences is nevertheless still exhibited *within* departments, then this relationship may fairly be attributed to *different* individual reactions to the *same* work situation.

One difficulty about testing this point is that in an iron and steel works the number of different departments is very great, making the number of stayers in any one department over the period studied small. However, four departments were found with twenty or more stayers, and a comparison of mean absences between the *Ao* and *A+* groups is made for the four depart-

ments in *Table X*. The departments are arranged in descending order of hazard from Open Hearth to Fitting Shop.

The departments represented include two of higher and two of lower degrees of hazard. The number of accidents (and absences) differ accordingly.

TABLE X *MEAN ABSENCES PER MAN AMONG Ao AND A+ GROUPS BY DEPARTMENT*

Department		*Open Hearth*	*Bricklayers*	*Traffic*	*Fitting Shop*
Number of Individuals	*A+*	13	12	5	2
Number of Individuals	*Ao*	10	17	17	18
Mean Absences per Individual	*A+*	34·77	30·80	13·20	20·50
Mean Absences per Individual	*Ao*	27·10	19·00	10·76	11·56

Nevertheless, the results confirm in each case the expectation that those having accidents go absent more often than those remaining accident free. The evidence available from departments supports the view that the positive association discovered between accidents and other absences arises essentially from a difference in individual reactions to the same work situation.

The Stability of the Differences over Time

Further, the association is relatively stable over time. If the mean other absences per half-yearly period are calculated for the *Ao* and *A+* groups

TABLE XI *MEAN OTHER ABSENCES PER MAN PER HALF-YEARLY PERIOD OF SERVICE AMONG ACCIDENT FREE (Ao) AND ACCIDENT SUSTAINING (A+) GROUPS*

Half Yearly Periods of Service	*1st*	*2nd*	*3rd*	*4th*	*5th*	*6th*	*7th*	*8th*	*Total*
Group *Ao*	1·82	2·18	1·97	1·82	1·77	1·80	1·78	1·91	15·03
Group *A+*	2·87	3·60	3·43	3·25	2·88	2·90	2·85	2·64	24·40

respectively, the results for the eight half-yearly periods available are as shown in *Table XI*.

The two series are completely discrete. The overall absence level of the accident sustainers is consistently higher than that of those who remain accident free. Membership of the conforming majority or of the deviant minority as regards level of absence tends to be a constant attribute.

In both groups the second half-yearly period has the highest absence rate, i.e., the beginning of the period of differential transit. But thereafter the rate for the *Ao* group evens out almost immediately, whereas that for the *A+* group drops much more slowly. Discussion of such points is reserved for the subsequent paper, which will be specifically concerned with the course of the adjustment process in the *Ao* and *A+* sub-groups with respect to changes occurring through time in the quality of the person-organization relationship. For the present purpose it is sufficient to show that the differences found are a consistent feature of absence behaviour throughout the period as a whole.

V. THE RELATION OF ACCIDENTS TO DIFFERENT FORMS OF OTHER ABSENCE

A Frame of Reference in Terms of Sanctioning and Responsibility

It is now proposed to examine the relation of accidents to the various forms of withdrawal included in the overall grouping of "other absences". The categories available from the records arise from the needs of the organization as an employing institution to regulate its relationships with employees in matters pertaining to absence from work. A man is employed and paid to be present and able to work between certain hours. If he is not present his absence must be considered as perceived in the "absence culture" operating in the firm.

Within this framework, other absences may be categorized according to their position on two parallel scales, one sociological and the other psychological—the first in terms of the degree of sanction received from the employing institution, and the second in terms of the degree of acceptance of responsibility by the person himself for his actions. The types recorded may be grouped into the following three classes:

1. *Prospectively Sanctioned Absences*—where permission to be absent is asked and granted beforehand. This implies a high degree of acceptance of responsibility by the individual concerned. (Included is only the relatively small number of permission absences.)
2. *Retrospectively Sanctioned Absences*—where although permission is not asked beforehand, the absence is ratified on return to work. This implies that the conduct of the individual is within, and accepted as within, certain cultural values regulating his relationship with the employing institution. (Included are both certified and uncertified sickness and sufficient reason able-bodied absences.)
3. *Unsanctioned Absences*—where the above is not the case, and either no

TABLE XII *DISTRIBUTION OF NUMBER OF OTHER ABSENCES PER INDIVIDUAL AMONG THOSE WHO HAD ACCIDENTS (A+) AND THOSE WHO DID NOT (Ao)*

Number of Absences	*Prospectively Sanctioned*		*Retrospectively Sanctioned*		*Unsanctioned*	
	Ao	*A+*	*Ao*	*A+*	*Ao*	*A+*
0	151	79	14	1	38	4
1	27	7	14	2	23	6
2	10	–	17	6	19	7
3	7	1	19	8	16	6
4	3	1	22	4	13	1
5	–	–	12	5	12	4
6	1	–	13	7	12	4
7	–	–	18	5	5	5
8	–	–	8	8	2	4
9	–	1	10	3	7	7
10	1	–	10	6	4	1
11	–	–	6	4	4	2
12	–	–	3	5	4	1
13	–	–	6	8	6	2
14	–	–	12	2	2	2
15	–	–	3	1	3	3
16	–	–	2	5	–	2
17	–	–	2	2	6	1
18	–	–	1	1	1	2
19	–	–	1	–	1	1
20	–	–	2	1	3	1
21	–	–	1	1	1	1
22	–	–	–	1	3	3
23	–	–	–	–	–	2
24	–	–	1	–	–	1
25	–	–	–	–	–	–
26	–	–	–	1	–	2
27	–	–	–	–	1	–
28	–	–	2	–	–	–
29	–	–	–	–	3	–
30	–	–	1	–	1	–
Over 30	–	–	–	2	10	14
Total Individuals	200	89	200	89	200	89
Total Absences	96	23	1378	861	1533	1287
Mean Absences per Individual	0·48	0·26	6·89	9·67	7·67	14·46

excuse is given by the individual on return to work, or the excuse given is unacceptable, and his conduct is condemned. This implies a low degree of acceptance of responsibility by the individual, and a rejection of the culture. (Included is the large group of no reason able-bodied absences.)

A property of this scheme is that high or low degrees of sanction and of acceptance of responsibility go together.

Accidents in this Frame of Reference

In the case of accidents, however, this positive relationship between degree of sanctioning and degree of acceptance of responsibility on the part of the individual does not hold. Absences due to accidents are possibly the most highly sanctioned of all types of absence from work, whereas "an accident" is precisely an event for which the individual does not himself usually accept responsibility.

It has been established that membership of the accident sustaining group tended to coincide with membership of the deviant minority characterized by a higher overall level of absence: 73 percent of these absences consisted in "taking the day off"; and among these, 53 percent were of the no-reason, i.e., unsanctioned type.

If these considerations are put together the expectation arises that accidents will be associated with absenteeism in the pejorative sense, despite the highly sanctioned character of the absences directly arising from the accidents themselves. In a more general form the postulate may be expressed as follows: that accidents will tend to be most associated with the least sanctioned, and least associated with the most sanctioned forms of absence.

The results, given in *Table XII*, confirm these expectations. Prospectively sanctioned absences are, in fact, *negatively* associated with accidents—a ratio Mean $A+$/Mean Ao absences gives a value of 0·56. Retrospectively sanctioned absences are positively associated, with a ratio of 1·40, while unsanctioned absences are even more positively associated, with a ratio of 1·89. A test by χ^2 of the proportions in the Ao and $A+$ groups having no absences in the relevant category confirms this ordering in each case: values are 6·66 (prospective sanction—negative association), 4·33 (retrospective sanction—positive association) and 10·43 (unsanctioned—positive association). These values, with one degree of freedom, are all significant.

On the background of this general finding, an examination will now be made of the relationship of accidents to the various forms of retrospectively sanctioned absence, taken separately—beginning with the able-bodied sufficient reason type and proceeding to certified and uncertified sickness.

Accidents and Sufficient Reason Able-Bodied Absences

Absences properly included under this heading refer to genuine instances of "interference" from events in other parts of the life space: sickness in other

members of the family, other difficulties in the home, etc. A certain amount of interference with attendance at work from events of this kind is to be expected. But in the absence culture which provides sanction for absences of this type at Park Gate there is an understanding that there will be moderation in their use. Rejection of the recognized absence culture may show itself just as much in the excessive use of a form which is sanctioned as in the use of unsanctioned forms.

Moreover, an individual whose work-life appears susceptible to an unusual amount of interference from events lying outside it is not unlike an individual who has accidents. Things happen to him—or rather to someone to whom he is closely related ("the wife", for example)—so that it is not his

TABLE XIII *RETROSPECTIVELY SANCTIONED ABLE-BODIED ABSENCES*

No. of Absences	*Number of Individuals*		*No. of Absences*	*Number of Individuals*	
	Ao	*A+*		*Ao*	*A+*
0	49	18	11	–	1
1	44	13	12	–	–
2	36	13	13	1	1
3	21	12	14	1	1
4	14	8	15	–	2
5	12	5	16	–	–
6	7	6	17	–	–
7	6	4	18	–	–
8	6	2	19	1	–
9	1	–	20	–	1
10	1	1	Over 20	–	1

Total Individuals: *Ao* = 200 *A+* = 89
Total Absences: *Ao* = 492 *A+* = 343
Mean Absences per Individual: *Ao* = 2·46 *A+* = 3·85

responsibility that he cannot come to work. The objective reality of the impeding circumstances makes no difference to their psychological implication, for individuals who tend to act out their internal difficulties in this way tend to acquire relationships and environments which provide the circumstances in suitable measure.

The expectation arises therefore that a moderate use of retrospectively sanctioned absences of the sufficient reason able-bodied type would be independent of the occurrence of accidents, but that an excessive use might be positively associated.

Of the total of 2,239 retrospectively sanctioned absences, 835 were recorded as able-bodied and these were divided among individuals in the *Ao* and *A+* groups as shown in *Table XIII*.

The mean number of absences per individual is higher in the *A*+ group than in the *Ao* group and the ratio as before is 1·57. A test by χ^2, however, of the proportion in each group having no absences gives a non-significant value of 0·64 with one degree of freedom. This would imply that the mean difference must arise from differences in the tails of the distributions. If, for the purpose of testing, a division is made between those having more than five absences and those having five or less, the value of χ^2 becomes 5·24 which is significant, and the results are accordingly consistent with the postulate.

Accidents and Sickness

With regard to sickness absence, a distinction must be drawn between cases of certified sickness, which tend to belong to the second and longer of

TABLE XIV *SICKNESS ABSENCES—NUMBER OF CASES PER INDIVIDUAL*

Number of Cases	*Certified Sickness*		*Uncertified Sickness*	
	Ao	*A*+	*Ao*	*A*+
0	59	10	68	18
1	46	25	45	24
2	32	16	21	8
3	21	10	12	10
4	14	12	14	6
5	11	6	11	4
6	7	2	10	6
7	5	2	6	3
8	1	2	2	3
9	1	1	3	1
10	1	1	3	3
11	2	2	–	1
12	–	–	2	–
13	–	–	–	2
14	–	–	3	–
Over 14	–	–	–	–
Total Individuals	200	89	200	89
Total Absences	410	248	475	271
Mean Absences per Individual	2·05	2·79	2·38	3·04

the two time scales, and minor ailments, which tend to conform to the day-off pattern, where a doctor's certificate is not sought. It may be recalled that of the total of 1,404 sickness absences 658 were certified and 746 uncertified, and that certified sickness averaged 13·4 days lost per absence while uncerti-

fied averaged only 1·4. In both these forms the extent to which purely physical factors are operating is of course a matter of doubt. Nevertheless, the extent to which different individuals will respond to a given physical stimulus by going absent will obviously vary according to their already existing propensities to go absent. Thus, from the results already established some positive association may be expected to exist between accidents and sickness, although without further information the extent of this is indeterminate. In *Table XIV* the distribution of cases per individual is given divided as before into *Ao* and *A+* groups.

The results confirm the expectation of a positive association. The mean and the mode have a higher value in the *A+* groups and the ratio Mean *A+*/Mean *Ao* absences per individual is 1·36 for certified and 1·28 for uncertified sickness. Tests on the differences between the proportions in the *Ao* and *A+* groups having no absences in the relevant category give significant values of χ^2 of 11·31 (certified) and 5·59 (uncertified), both with one degree of freedom. But within the limits of the data available no attempt could be made to distinguish between different types of illness, and in their common relation to accidents the broad groupings of certified and uncertified sickness are very much alike.

VI. DISCUSSION

The ordering which has been obtained from the data given in this study suggests that absence phenomena reflect the quality of the relationship of the person to the employing institution. This is affected by the extent to which the firm is perceived by the individual as a good employing authority, to whom he acts in a good (responsible) way. To have accidents, go sick, or voluntarily to absent oneself may be different forms of negative reaction implying a bad relationship arising in the individual in various ways, which are not fully acknowledged. The association of the former two kinds of absence, perceived as "involuntary", with the latter, perceived as "voluntary", suggests that sickness and accidents may both be forms of motivated absence—however unconscious the motivation.

Naturally it cannot be maintained that all cases of sickness and accidents are positively motivated and genuine interference obviously takes place from the physical work environment and from other regions of the life space. The relative strengths of these two sets of factors cannot be assessed from the data available—all that can be said is that they are both present. Much further work is necessary to separate out these factors and identify their components with greater precision.

If the conflicts involved were all merely a question of a specific bad relation with a particular firm, one would expect the person concerned to leave or be dismissed. But these reactions occur among a quasi-permanent remainder, and the *Ao* and *A+* groups remain distinct throughout the four-year period studied.

A fundamental question may now be posed. How far is a tendency to go absent more frequently than is the custom (for a variety of reasons, including that of an accident) an unalterable pattern, or how far do certain changes occur over time in the level and form of accidents and other absences and in their relations to each other? A study of such possible changes will be made the subject of a further report. Particular attention will be paid to any signs from the available indicators of a capacity on the part of members of the absence addicted minority to improve their relationship with their employing authority and (among many other things) to learn to avoid accidents.

VII. SUMMARY AND CONCLUSIONS

1. The need is shown to develop a social psychological approach to the question of industrial accidents, which are considered as a means of withdrawal from the work situation. The inquiry made concentrates on the absence effects of accidents and examines their relation to other forms of absence from work.

2. Methods appropriate to such a study are described, absences (on whatever grounds) being regarded as the obverse of labour turnover—being away from a job still held, in contrast to leaving it for another.

3. The absence behaviour as a whole is considered of a stabilized working population among whom there was no labour turnover in one firm over a long period of time (four years).

4. A descriptive account is given of the absence and accident characteristics of this stabilized group. There is strong evidence of social patterning, and the accidents are mostly everyday mishaps.

5. Accidents are distinguished from other forms of absence since the events which are their immediate source can be definitely related to that part of the life space comprised by the person-work relationship.

6. So far as accidents are positively motivated forms of absence they might be expected to be positively associated with other forms. This is found to be the case, the group of deviates from the social norm sustaining more accidents than the rest.

7. These other forms of absence are then divided into socially perceived categories and ordered according to two parallel scales, one sociological (in terms of the degree of sanction given by the organization to the individual to be absent) and the other psychological (in terms of the degree of acceptance of responsibility by the individual for himself and his actions).

8. It was postulated that accidents would tend to be most associated with the least sanctioned forms of absence. This has been found to be the case. In fact, accidents are negatively associated with that form of absence requiring prospective sanctioning (i.e., the seeking and granting of permission beforehand), while the highest degree of positive association is with "no reason" able-bodied absence (i.e., "absenteeism" in the strict industrial sense).

9. Retrospectively sanctioned absences, where the conduct of the individual is accepted as lying within certain cultural values regulating his relationship with the employing institution, are then considered, and it is demonstrated that these have a degree of association lying between the other two forms.

10. Retrospectively sanctioned absences are subdivided into able-bodied and sick. With regard to the former it is found that a moderate use of this form of sanctioned absence is independent of the occurrence of accidents, whereas an excessive use is positively associated.

11. It was not possible on the basis of the data available to discriminate diagnostically between purely physical forms of disability and those in which some form of conscious or unconscious motivation was operating. Nevertheless, to the extent to which psychological factors were operating it was expected that absence due to sickness would be associated with that due to accidents. Such an association is shown to exist.

12. Absence phenomena are considered to reflect the relationship of the person to the employing institution and a brief discussion is offered of some of the implications from a personality point of view. Further work suggested concerns changes that may occur through time in the level and form of absences and accidents, and in their relations with each other.

REFERENCES

1. DUNBAR, F. *Psychosomatic Diagnosis*, New York, 1943.
2. HILL, J. M. M. "A Note on Labour Turnover in an Iron and Steel Works", *Human Relations*, Vol. VI, No. 1, 1953.
3. Productivity Team Report on Iron and Steel, Anglo-American Council on Productivity, U.K. Section, 21 Tothill Street, London, S.W.1, 1953.
4. RICE, A. K. "An Approach to Problems of Labour Turnover", *British Management Review*, Vol. XI, No. 2, 1953.

BIOGRAPHICAL NOTE

J. M. M. HILL graduated in Philosophy, Politics, and Economics at Oxford in 1949. In November of the same year he joined the Tavistock Institute of Human Relations as Research Fellow in social statistics; subsequently he remained as a staff member until August, 1951, when he joined the Operational Research Section of the British Iron and Steel Research Association. Recently he joined the Glacier Metal Company as a Research Officer.

E. L. TRIST; notes appeared in *Human Relations*, Vol. I, No. 2, and in Vol. III, No. 4.

APPENDIX I

After discussion with the iron and steel works involved, and taking into account the comparable records available, it was decided to take the group of entrants who entered the firm in the year 1947 as a basis and to record for

each individual, their characteristics at entry and all events in their career until 1951, as fully as possible. The information obtained was as follows :

1. Clock Number (for subsequent identification where necessary).
2. Date of Birth.
3. Sex.
4. Whether or not suffering from disability at entry.
5. Previous employment immediately before engagement (School, Armed Services, Mining, Other Steel Works, Other Engineering Works, Miscellaneous).
6. Whether previously employed at the works before, and if so when and for how long.
7. Date of entry and date of leaving, with recorded reasons for leaving (Own Request, Company Request, Death, Retirement, Health, Call Up).
8. First and succeeding departments with dates of transfer.
9. First and succeeding occupations with dates of transfer.
10. Dates and duration of all absences, with reasons (Certified Sickness, Uncertified Sickness, "Permission", "Sufficient Reason", "No Reason").
11. Information on all accidents sustained:
    - (i) Date.
    - (ii) Time Lost, if any.
    - (iii) Classification (Machinery, Vehicles, Burns, Occupational Disease, Falls of Employees, Stepping on or Striking Objects, Hit by Falling Objects, Handling Objects, Hand Tools, Miscellaneous).
    - (iv) Cause. (As recorded in the works, Carelessness (injured worker), Unavoidable Accident, Slippery floors, Worn or Unsuitable Tools, Unsafe Stacking, Faulty Material, Carelessness (other worker), Confined Space, Not using Safety Gear, Distraction, Insufficient or Faulty Guarding, Untidiness, Bad-light, Unsafe Electrical Apparatus, Unsafe Practice since discontinued, Loose Clothing, etc.)
    - (v) Place (Department), and occupation at time of occurrence. (Following Normal Occupation, Doing Unusual Job on Request, Passing through Plant in normal manner, Unauthorized Activity.)
    - (vi) Part of body injured.
    - (vii) Time of day at which accident occurred.
    - (viii) Whether or not a safety appliance was used.
    - (ix) Result, e.g. transfer, disability, etc.

SOCIAL PERCEPTION AND EFFECTIVENESS IN DISCUSSION GROUPS [1]

N. L. GAGE and RALPH V. EXLINE

This study deals with effectiveness in discussion groups as a function of the member's accuracy of social perception, his similarity to the group and his assumed similarity to the group, all in terms of opinions relevant to the group's concerns. By social perception, we mean perception of social characteristics, such as attitudes and opinions, of individuals or groups. One aspect of social perception is accuracy, which has received almost all the attention of investigators of social perception, in terms of such concepts as "empathy", "sensitivity", and "understanding". In addition to the accuracy of social perception, this study deals with two other possible factors in social interaction: similarity and assumed similarity. These have received much less attention in previous theoretical and empirical work; we have developed and tested hypotheses relating these to social behavior.

ACCURACY OF SOCIAL PERCEPTION

We define accuracy of social perception as the degree to which an individual's perceptions of characteristics of other individuals or of groups agree with what is actually the case concerning those others.

This concept may have important potentialities for understanding and predicting human relations. A technique for locating people who perceive others accurately might enable us to make successful predictions concerning the ultimate leaders in initially unstructured group situations, but only, of course, if accuracy of social perception is significantly related to effectiveness

1. The data for this study were collected at the Fourth National Training Laboratory for Group Development, Bethel, Maine, during June and July, 1950. We are grateful to the staff of the Laboratory for making the study possible, for assisting us in the collection of data, and for many helpful suggestions in planning the study. The Group Opinion Survey, Post-Meeting Reaction Sheet, and Group Questionnaire which we adapted in various ways, were developed by the Laboratory staff. The study was also supported by a grant from the Bureau of Educational Research of the College of Education, University of Illinois.

in interpersonal relations. It is just at this point that the evidence is inconclusive and even contradictory.

On the one hand, Chowdhry and Newcomb (1) found that, on items relevant to the group's activity, group leaders were more accurate in perceiving group opinion than were other members of the groups. Wood (9) concluded that "Individuals (high school students) receiving the largest number of sociometric choices were significantly better judges of group opinion than students who received few or no choices." Gage and Suci (2) found a significant positive relationship between accuracy of teachers' perception of attitudes held by the student body, and the degree to which they were liked by their students.

But other investigations have yielded apparently contradictory conclusions. Studies of Naval leadership (10) carried out under the auspices of Ohio State University produced no significant results when ability to estimate the opinions of a ship's crew was correlated with officers' popularity as leaders, or when the amount of the tendency to overestimate morale was correlated with popularity as leaders. In eight undergraduate fraternities, Hites and Campbell (3) found no consistent differences in ability to estimate group opinion among appointed leaders, elected leaders, or non-leaders. Sprunger (7) reported negative conclusions as to the existence of such a relationship in his study of supervisors of an insurance company's office employees.

In view of this contradictory evidence, there is need for further examination of the relationship between (*a*) the ability to estimate the opinions of a group and (*b*) effectiveness in interpersonal relations within the group.

"SIMILARITY" AS A FACTOR IN INTERPERSONAL RELATIONSHIPS

By similarity we mean the degree to which the characteristics, say attitudes and opinions, of one individual resemble those of another individual or group. Operationally, we can define similarity as the correlation of an individual's own responses to a series of opinion items with the responses of another individual or group. The higher the correlation, the greater the similarity of the individual to the individual or group with which he is being compared. In a sense, similarity is the same as the notion of "sharing norms" when the similarities are being measured in terms of the degree to which various individuals or groups hold attitudes and beliefs which govern interpersonal relationships or group behavior, i.e., which are norms. Similarity is not, of course, a form of social perception but rather a factor possibly affecting social perception and its consequences.

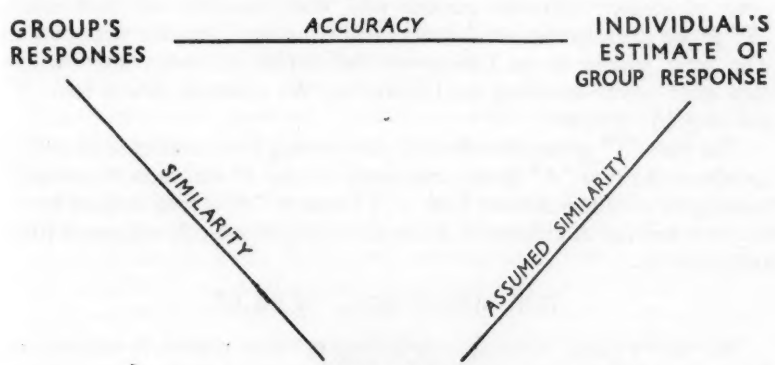
We assume that similarity of an individual to a group affects the way in which the individual behaves in the group and interacts with its members. Membership in a group may be defined in socio-psychological terms as the

sharing of group norms and being recognized by the group as a member. In this study we investigate on a preliminary basis the hypothesis that the individual's similarity to the group in presumably relevant beliefs and attitudes is positively correlated with his effectiveness as participant in the group's activities.

ASSUMED SIMILARITY AS A FACTOR IN INTERPERSONAL RELATIONSHIPS

By assumed similarity we mean the degree to which the individual assumes that another individual or a group hold attitudes and opinions characteristic of himself. Operationally, assumed similarity can be defined as the correlation between an individual's own attitudes and opinions and those which he estimates another individual or group to have. The higher the correlation, the greater the degree of assumed similarity. If a person assumes similarity between himself and the group, he should expect his own interests and needs to be better served by effective activity toward the attainment of the group's goals. Perhaps it is allowable to think of assumed similarity as conducive to a kind of willingness to "pitch in" and work for the values of the group. Assumption of similarity may be false. In any case, however, assumed similarity may be taken as an indication of individual belongingness, which by Newcomb's definition (5, p. 633) is "a predisposition to find motive satisfaction by taking a member's role, in confident anticipation that one's own understanding of the group norms is shared by other members". We may hypothesize therefore that the individual's assumed similarity to the group is positively correlated with his effectiveness in the group.

Our operational definitions of accuracy, similarity, and perceived similarity may be shown schematically as follows:



The lines connecting the sets of responses represent correlations between the sets. These correlations provide our measures of accuracy, similarity, and assumed similarity.

As described below, we also used two alternative measures of accuracy of social perception: accuracy in predicting the (*a*) reaction to, or satisfaction with, the group's meeting, and (*b*) the choices of the group as to its most productive members.

SUBJECTS

Delegates to the fourth summer session of the National Training Laboratory for Group Development were divided into groups of fifteen to twenty-five members. The groups met to examine the processes operating in small groups, using group discussion as their method. The Laboratory training period lasted three weeks, during which the discussion groups met two hours daily, except on weekends.

The delegates held positions of responsibility in a diversity of organizations in business and industry, education, federal and state government, welfare work, and the armed forces. Most of the delegates were regularly involved in on-the-job operations which required them to work as members of groups toward common goals.

Each delegate was assigned to a "T" group which met in the morning to study the forces operating when a number of people seek to organize themselves into an effectively functioning group. Each delegate was also assigned to an "A" group which met in the afternoon to gain practice in team or group operation in action situations.

Organizations which sent delegates to the Laboratory were encouraged to send teams of two or more delegates. "A" group membership involved being in a group with some people from one's own organization along with other previously unknown persons who were members of other teams. "T" group membership, on the other hand, involved meeting with persons who were, insofar as the Laboratory staff could determine, unknown to each other before attending the Laboratory. We collected data in two "T" and two "A" groups.

The two "T" groups involved in this investigation numbered 15 and 18 members; the two "A" groups contained 21 and 22 members. Since some individuals were members of both a "T" and an "A" group studied by us, the total number of different individuals serving as subjects amounted to 68 instead of 76.

THE MEASURING DEVICES

We have already referred, in reviewing previous studies, to instruments designed to differentiate among individuals as to their ability to predict the responses of a group. We used such instruments as measures of our independent variables. Sociometric devices were used to obtain measures of the social

effectiveness of individuals, that is, measures of the dependent variables. A brief description of these instruments follows.

Estimation of Group Opinion Test (*EGOT*).—The subject was asked to estimate how many people in his "A" or "T" group would agree with each of fifty statements concerning group process, leadership, the scientific study of human relations, methodology of group action, and the like. For example, suppose an individual thought that three members (including himself) would agree with the statement: "One of the best ways to clarify a person's ideas is to discuss them in a group." He would place the number "3" to the left of the statement. The fifty statements were taken from a 100-item Group Opinion Survey administered twice to all delegates to the Laboratory, first, soon after their arrival and, again, at the end of the three-week session. The two administrations were intended to make possible tests of our hypotheses with data collected both early and late in the Laboratory's work. The actual frequencies of "agree" responses of the group on these 50 items provided the key against which the estimates of the individuals were scored. The 50 items used in the second administration were different from, but equivalent to, those used in the first.

a. Accuracy score.—A score for each individual was derived by correlating his estimate of the group's response to each of the fifty items with the actual number of people in his group who responded affirmatively. The resulting Pearsonian *r* is the individual's accuracy score (EGOT *r*-score) on the test.

b. Similarity score.—The similarity score is the *r* between the individual's own responses on the five-point scale (1. disagree strongly, 2. disagree, 3. undecided, 4. agree, 5. agree strongly) and the number of persons in the group who agreed with each of the 50 statements.

c. Assumed similarity score.—The assumed similarity score was obtained by computing the *r* between the individual's own response on the five-point scale and his estimate of the number of individuals in the group who would agree with each of the 50 statements.

Post Meeting Reaction Estimate (*PMRE*).—In this test the subjects were asked to answer the question: "How did you feel this meeting was today?" The subjects responded by checking a scale ranging from "No good" through "Mediocre", "All right", and "Good", to "Excellent". They were asked to consider the scale as a continuum and not to locate themselves at the described points only. To score this device, the distance on a 12-point scale from one end of the line to the check mark was measured. This score represented each individual's satisfaction with the meeting. Each individual next was given a sheet which contained similar scales opposite the names of all other individuals in his group. He was asked to use the scale to indicate how he thought each other member of the group felt about the meeting. A key developed from the actual answers of all individuals was then applied to the estimates, and the PMRE *r* score was obtained by correlating the individual's

estimates of all other individuals in a group with the actual responses of those individuals.

Productivity.—Each individual in the group was asked to rank in order the five members of his group who contributed most to the productivity of the group. Weights were assigned as follows: first choice, 5; second choice, 4; third choice, 3; fourth choice, 2; fifth choice, 1. Weighted choices for each individual in the group were summed; the total was used to rank the individual as to his productivity in the group.

Estimate of Productivity (*EOP*).—In this test, the subjects were asked to estimate, in rank order, which five members of the group would be chosen by the group as a whole as the most productive members in the group. Each individual ranked his choices from one to five. The rankings of those five by each individual were then compared with their actual rank as indicated by the sums of the group's ranking of individuals as to their productivity. The discrepancies between an individual's estimate of the group rankings and the actual group rankings were summed to obtain an individual's EOP score.

Sensitivity.—Each individual in the group was asked to rank in order the five members of his group who were most sensitive to the feelings and attitudes of other members. Ranks of members on this dimension were obtained as described for "Productivity".

Leisure Time Attractiveness.—Each individual in the group was asked to rank in order the five members of his group with whom he would most like to spend leisure time. Ranks of group members on this dimension were obtained as described for "Productivity".

These tasks were given to the four groups on two occasions: first, on the third working day, and second, on the twelfth of the fifteen working days in the Laboratory's program.

The administration of the first tests was delayed until the third day to allow the delegates to be in contact with their fellow group members during three two-hour meetings. This was considered long enough to insure that judgments concerning the opinions, feelings, and attitudes of other members would be based on clues at least minimally adequate.

The final administration of the tests took place as near the end of the Laboratory session as possible. The eighteenth actual day (twelfth working day) of the Laboratory was selected as best meeting the need to give the delegates a maximum of time to interact with one another and still avoid various distractions arising in the last few days of the Laboratory.

The order of testing was as follows:

1. Estimation of Group Opinion Test
2. Group Questionnaire
   Selecting and ranking the highest five members of the group as to
   a. Productivity
   b. Sensitivity
   c. Leisure Time attractiveness

3. Estimate of Productivity
4. Post Meeting Reaction of self
5. Post Meeting Reaction Estimate

All EGOT's were taken prior to the final administration of the Group Opinion Survey, which was given to all members of the Laboratory. This insured that an individual's estimate of the group's opinions would not be influenced by any prior knowledge of how others had actually answered the questions. All PMRE's were taken at the end of the work session to which they applied so that each member had an entire work session by which to judge the satisfaction of his fellow members.

ANALYSIS OF DATA

Statistical Significance of EGOT r Scores.—How well were the subjects able to predict the collective responses of their group to the items of the Group Opinion Survey? If the predictions were not significantly accurate, that is, better than chance guessing would allow, we could not consider EGOT *r* scores to reflect any real accuracy of social perception. Also, what levels of similarity and assumed similarity did the groups exhibit? *Table 1*

TABLE 1 *MEANS AND RANGES OF EGOT r SCORES IN FOUR GROUPS ON DAY 3 AND DAY 12*

	Group Day 3	A1 *Day 12*	*Group Day 3*	A4 *Day 12*	*Group Day 3*	T2 *Day 12*	*Group Day 3*	T3 *Day 12*
				EGOT Accuracy *r*				
N	20	20	21	21	15	15	18	17
Mean	·57	·54	·57	·57	·59	·55	·56	·63
Range	·35 to ·76	·32 to ·74	·18 to ·82	·11 to ·75	·36 to ·84	—·26 to ·81	—·22 to ·88	—·17 to ·88
				EGOT Similarity *r*				
N	19	21	19	20	15	15	17	18
Mean	·59	·58	·80	·69	·66	·54	·68	·70
Range	·22 to ·85	·42 to ·79	·52 to ·82	·44 to ·89	·29 to ·85	·44 to ·83	·36 to ·84	·35 to ·86
				EGOT Assumed Similarity *r*				
N	18	20	19	19	15	15	17	17
Mean	·58	·59	·59	·57	·62	·55	·55	·57
Range	—·14 to ·86	·36 to ·74	·14 to ·88	·21 to ·85	·27 to ·80	—·19 to ·90	—·03 to ·80	—·35 to ·90

shows the means and ranges of these EGOT *r* scores for each of the four groups on each administration. The means are based on weighted *z*-transformations of *r*.

Since the number of cases in each of these *r* scores is 50, or the number of items in the Estimation of Group Opinion Test, *positive* values of *r* significant at the ·025 and ·005 levels are about ·27 and ·35, respectively. Most of the EGOT *r* scores are therefore significantly greater than chance.

The ranges of these scores indicate further that our subjects differed materially in whatever EGOT was appraising.

Reliability of the Measures.—We investigated reliability in terms of internal consistency, an odd-even coefficient corrected by the Spearman-Brown formula. To reduce the labor involved, we used the sums of discrepancies between estimates and actual group response for each item; these were correlated to obtain a split-half coefficient. This would give us an estimate of the consistency with which the subjects estimated accurately the group's response to the Group Opinion Survey items.

Table 2 shows the reliability coefficients and the standard deviations and means of the odd-even splits. The coefficients are sufficiently high, ranging

TABLE 2 *CORRECTED ODD-EVEN COEFFICIENTS OF EQUIVALENCE OF THE EGOT ERROR SCORES*

Group	N	Mean		S.D.		Coefficient of Equivalence
		Odd	Even	Odd	Even	
Day 3						
A1	20	117·50	122·50	18·59	23·74	·68
A4	21	131·20	132·60	37·78	41·02	·87
T2	16	91·50	89·10	17·56	15·95	·68
T3	18	113·90	95·00	44·96	31·68	·84
Day 12						
A1	20	115·00	107·50	31·03	22·44	·66
A4	21	126·80	121·00	29·21	37·40	·92
T2	16	96·90	88·10	46·59	32·66	·93
T3	17	87·40	84·40	42·63	36·25	·84

from ·66 to ·92, to indicate that the task of estimating group opinion produced a substantial degree of non-error variance among the subjects.

Table 3 shows the corrected split-half reliability coefficients of the PMRE test. These *r*'s were very low, ranging from ·00 to ·87 with a median

TABLE 3 *CORRECTED SPLIT-HALF COEFFICIENTS OF EQUIVALENCE FOR FOUR GROUPS ON PMRE TEST, DAY 3 AND DAY 12*

Group	N	Day 3 Coefficients	N	Day 12 Coefficients
A1	20	—·01	21	·43
A4	22	·47	21	·87
T2	15	·52	15	·47
T3	18	·44	17	·44

of about ·45, and indicating that in general these PMRE measures could not be expected to correlate highly with other variables.

Reliability coefficients were not computed for the EOP instruments since they did not furnish the necessary data.

Since our measures of effectiveness are sociometric indices, the concepts of validity and reliability do not apply in the usual ways, as Pepinsky (6) has pointed out.

We can, however, estimate the internal consistency of the sociometric measures. If we split the group into random halves, compute the productivity rank for each member by summing the ranks given him by the members of each random half, correlate the ranks so obtained, and apply the Spearman-Brown formula, the coefficient indicates the internal consistency of the group in judging the productivity of its members. The same procedure applies to the sensitivity and leisure time attractiveness ranks. When this procedure was carried out we obtained the results shown in *Table 4*. The coefficients of equivalence for productivity and sensitivity are

TABLE 4 *CORRECTED SPLIT-HALF COEFFICIENTS OF EQUIVALENCE OF THE SOCIOMETRIC RANKS ASSIGNED BY EACH GROUP*

Group	*Productivity*	*Sensitivity*	*Leisure Time Attractiveness*
	Day 3		
A1	·86	·68	·29
A4	·86	·77	·66
T2	·75	·67	·50
T3	·88	·84	·47
	Day 12		
A1	·90	·87	·36
A4	·96	·67	·54
T2	·88	·56	·86
T3	·80	·72	·48

fairly high, the respective medians being ·87 and ·70. The median coefficient for the rankings of leisure time attractiveness is, however, only ·49. This merely reflects the more individualistic frame of reference of the subjects in choosing the members they prefer as companions in leisure time activities. On the whole, the coefficients for these measures, especially as to productivity and sensitivity, indicate a substantial amount of consistency within each group.

We can also ask whether a sociometric test is valid in the sense of eliciting relevant responses without falsification. Such "validity" is enhanced when we establish rapport, provide a task which is unambiguous, ask the subjects to make positive choices only, and have the subjects rank only a small number of the group (4). The sociometric questions and administrative procedures met these requirements sufficiently to indicate that satisfactory "validity" was obtained.

Intercorrelations among Measures of Independent Variables.—As already indicated, we have five independent variables:

a. Accuracy of social perception in terms of EGOT Accuracy.
b. „ „ „ „ „ „ „ PMRE *r* score.
c. „ „ „ „ „ „ „ EOP error score.
d. EGOT Similarity.
e. EGOT Assumed Similarity.

In what ways are these measures interrelated? Particularly, how are the three measures of accuracy of social perception related? The rank-difference coefficients of correlation among all five measures for Day 3 and Day 12 are shown in *Table 5*. It is evident that the coefficients vary greatly from group to group, and there is no marked tendency for those for any single group to be different, either higher or lower, than those for the other groups. These unstable relationships may of course reflect merely low reliability of the scores, or they may indicate an essential difference among the measures as to their psychological meaning. In either case, these intercorrelations are so low that we have no justification for letting one of these measures stand for or replace any of the others in subsequent analyses.

If we compare the relationships in *Table 5* among pairs of EGOT-based variables, certain definite trends become apparent. The correlations between Assumed Similarity and Accuracy are higher than those between Assumed Similarity and Similarity in seven out of eight comparisons within groups. Further, the correlations between Assumed Similarity and Accuracy are higher than those between Similarity and Accuracy in seven out of eight comparisons. It is highly likely that these trends largely reflect differences in the mean level of the third variable, the one not involved in the correlation between any two. That is, the fact that the correlation between Assumed Similarity and Accuracy tends to be higher than that between Similarity and Accuracy, results largely from the fact that the mean Similarity in any group tends to be higher than the mean Assumed Similarity of that group (See *Table 1*). Similarly, the correlation between Assumed Similarity and Accuracy tends to be higher than that between Assumed Similarity and Similarity, because the mean Similarity of any group tends to be higher than mean Accuracy. As to why the means of these scores should have this fairly consistent rank order of magnitude, we can only speculate; it may readily have been an artifact of the measuring techniques used.

Correlations between Accuracy of Social Perception and Effectiveness of Interpersonal Relationships.—In *Table 6* are shown the rank-difference coefficients of correlation (*rho's*) between our three measures of accuracy of social perception and our three sociometric measures of effectiveness in interpersonal relationships, for each of the four groups and each of the two administrations. For the most part the coefficients are not significantly different from zero. In some groups the correlations rise as high as ·4 or ·5, but in others the correlation between the same variables falls to zero or even becomes

TABLE 5 *INTERCORRELATIONS (RHO'S) AMONG INDEPENDENT VARIABLES IN FOUR DISCUSSION GROUPS ON DAYS 3 AND 12*

	PMRE *r*				EOP error				EGOT similarity				EGOT assumed similarity			
	A1	A4	T2	T3	A1	A4	T2	T3	A1	A4	T2	T3	A1	A4	T2	T3
Accuracy of Social Perception																
EGOT accuracy																
Day 3	·16	−·24	−·44	·09	−·02	·19	−·09	·49	·20	−·15	·82	·12	·20	·85	·92	·72
Day 12	−·09	·17	·44	·48	−·18	−·41	−·36	·18	·09	·14	·04	·45	·48	·82	·62	·74
PMRE *r*																
Day 3					·27	−·27	−·27	·14	·10	·60	−·43	·00	·13	−·11	−·49	−·16
Day 12					·02	−·29	·05	·15	−·30	·61	·11	·29	·06	−·02	−·01	·52
EOP error																
Day 3									·12	−·25	−·16	·38	·23	·34	−·25	·50
Day 12									·15	−·11	·18	·13	−·18	−·14	·11	·67
EGOT similarity																
Day 3													·68	·10	·88	·27
Day 12													·09	·28	·37	·56

TABLE 6 *CORRELATIONS (RHO'S) BETWEEN ACCURACY OF SOCIAL PERCEPTION MEASURES AND MEASURES OF EFFECTIVENESS IN INTERPERSONAL RELATIONSHIPS, DAY 3 AND DAY 12*

	Productivity Rank				*Sensitivity Rank*				*Leisure Time Attractiveness Rank*			
	A1	A4	T2	T3	A1	A4	T2	T3	A1	A4	T2	T3
					Day 3							
EGOT *r* rank	−·11	·08	·16	·43	−·22	·06	·03	·46	−·03	·10	−·13	·05
PMRE *r* rank	−·23	·07	·14	·34	−·29	·39	·12	·16	·10	−·05	·15	−·01
EOP error rank	·09	−·25	−·16	·51*	·26	−·36	−·15	·57*	·18	−·01	−·33	·18
					Day 12							
EGOT *r* rank	·29	·05	·00	·17	·17	·02	−·21	·41	·40	−·07	·07	·06
PMRE *r* rank	−·07	·26	−·64†	·42	−·14	·19	−·26	·57*	−·16	·25	−·19	·30
EOP error rank	·01	·13	·15	·24	·22	−·27	·15	·16	−·14	−·14	·46	·25

* Indicates significance at the ·05 confidence level.
† Indicates significance at the ·01 confidence level.

negative. The table may be interpreted as the reflection of chance alone operating. But if the measures of social perception and effectiveness are granted some logical validity or meaning by virtue of the operations by which they were obtained, these results mean that our hypotheses concerning accuracy of social perception and interpersonal relationships are unsupported. Or, at any rate, whatever truth these hypotheses may have is not sufficiently general to show up with any consistency from one group to the next. To put it another way, groups may differ radically as to the significance of accurate social perception for interpersonal relationships. In one group, T3, the relationships between all three measures of accuracy of social perception and our two most relevant sociometric measures (Productivity and Sensitivity) were consistently and often substantially positive, on both Day 3 and Day 12. In the other three groups the relationships generally differ from zero only slightly and without discernible meaning.

How does Group T3 differ otherwise from the other three groups? Discussion of this question might be fruitful, however vulnerable to the risks of *a posteriori* speculation, if it could be based on fairly systematic observational data. Since our observations of the groups were, however, highly informal and impressionistic, we shall forgo such discussion.

Correlations of Similarity and Assumed Similarity with Effectiveness in Interpersonal Relationships.—Table 7 shows the rank difference coefficients of correlation of our measures of Similarity and Assumed Similarity with our three sociometric measures of effectiveness in interpersonal relationships. The correlations with Productivity and Leisure Time ratings are so low and so inconsistently positive that we must consider our hypotheses to be unsupported. The same inconsistency characterizes the *rho's* between Assumed Similarity and Sensitivity. But the eight *rho's* between Similarity and Sensitivity are all positive, with the median at ·36. It seems fair to conclude tentatively that Similarity and sociometrically measured "sensitivity to the feelings and attitudes of others" are positively related.

This relationship indicates that those whose attitudes and opinions, as measured by the Group Opinion Survey, were most similar to those of the group tended to be those who were ranked highest by their group as "sensitive to the feelings and attitudes of others". This may mean that the sociometric choices as to sensitivity were subject to a readily understandable error: "Since you are similar to me, I feel you are understanding and sensitive." Operating for the group collectively, such an error should modify the meaning we assign to the Sensitivity ratings. Rather than true sensitivity, or accuracy of social perception (as measured by EGOT accuracy *r*), they seem to reflect a somewhat ego-centric tendency on the part of the group members to judge sensitivity in terms of the individual's agreement with the collective opinion of the group. Even so, such a tendency could arise only through the individual's behaving so as to reveal his degree of similarity to the group and through the group's perceiving this similarity. To

TABLE 7 *CORRELATIONS (RHO'S) OF SIMILARITY AND ASSUMED SIMILARITY MEASURES WITH MEASURES OF EFFECTIVENESS IN INTERPERSONAL RELATIONSHIPS, DAY 3 AND DAY 12*

	Productivity				*Sensitivity*				*Leisure Time Attractiveness*			
	A1	A4	T2	T3	A1	A4	T2	T3	A1	A4	T2	T3
Similarity												
Day 3	·03	·28	·27	·23	·66	·45	·28	·20	·28	—·29	·04	—·06
Day 12	·26	—·02	·17	—·10	·23	·25	·52	·60	·22	·18	·51	—·05
Assumed Similarity												
Day 3	·13	·00	·29	·11	·55	·01	·18	·34	·23	—·13	—·06	·09
Day 12	—·07	·18	·17	—·18	—·14	·15	—·15	·44	·05	—·09	·26	·44

TABLE 8 *CORRELATIONS (RHO'S) BETWEEN MEASURES OF INDEPENDENT VARIABLES ON DAY 3 AND MEASURES OF EFFECTIVENESS IN INTERPERSONAL RELATIONSHIPS ON DAY 12*

Measures of Independent Variables, Day 3	*Measures of Effectiveness in Interpersonal Relationships*, Day 12											
	Productivity Rank				*Sensitivity Rank*				*Leisure Time Attractiveness Rank*			
	A1	A4	T2	T3	A1	A4	T2	T3	A1	A4	T2	T3
EGOT Accuracy *r* Rank	—·21	—·15	·07	·35	—·02	·15	—·09	·36	—·23	—·09	·00	—·04
PMRE *r* Rank	—·04	·18	·06	·31	—·22	·13	—·22	—·08	+·27	—·17	—·17	—·10
EOP error Rank	·37	·01	—·11	·43	·17	·02	·16	·51	—·03	·08	·09	·28
Similarity *r* Rank	·04	·35	—·04	—·16	·62	·16	·14	·44	—·36	—·30	—·23	—·03
Assumed Similarity *r* Rank	·08	—·32	·04	·04	·51	—·12	—·19	·26	—·13	—·13	—·13	—·03

ascertain whether such perceptions of others' similarities to the group occurred, were accurate, and influenced ratings of sensitivity, would require data beyond those obtained in this study.

Correlations between Day 3 Social Perception Measures and Day 12 Effectiveness Measures.—If we consider the effectiveness measures to be dependent variables whose variance we are investigating as functions of our other measures, considered as independent variables, it becomes meaningful to inquire into the relationship between early (Day 3) social perception, Assumed Similarity, and Similarity, and later (Day 12) effectiveness. That is, early standings in accuracy of social perception, Similarity, and Assumed Similarity, could presumably determine later standing in effectiveness, if our hypotheses are valid.

Table 8 shows the pertinent correlations (*rho's*). Again, the coefficients hover generally around zero, are inconsistent from group to group, and provide no disproof of null hypotheses. In Group T3, again, all three measures of accuracy of social perception correlate positively with "productivity". In this group there is some support for our hypothesis that accuracy of social perception leads to behavior which the group will consider productive. But in the other T group, and in the two A groups, these relationships are not even consistently positive.

The only other sets of relationships that are all similar in sign are (a) those between EOP Error Rank and Sensitivity, and (b) those between Similarity and Sensitivity. The latter relationships occur in *Table 7*, while the former do not. For each of these sets, all four coefficients are positive, but vary greatly in magnitude. Unless these positive trends are nonetheless due to chance (and the chances in each case are one in 16 that this could occur under equal probabilities of positive and negative coefficients) we may tentatively conclude that accuracy of social perception as measured by EOP error Rank is positively related to sociometrically rated sensitivity, and that similarity to the group as measured by Similarity *r* Rank is also positively related to sociometrically rated sensitivity. Both of these relationships, it will be remembered, are between Day 3 independent variables and Day 12 sensitivity.

DISCUSSION

These findings indicate that, on the whole, there are no general relationships between the independent variables we have spelled out and sociometrically estimated effectiveness as a member of a discussion group. Accuracy in predicting (a) the group's opinions, (b) satisfaction with meetings, and (c) ratings of productivity did not correlate highly or positively with perceived effectiveness in the group's work. Further, similarity and assumed similarity to the group do not consistently correlate positively with sociometrically estimated productivity (which we used as our major criterion of "effectiveness").

We do not wish, however, to infer from these results that there is little or no justification in constructing and testing further hypotheses concerning relationships between our variables and perceived social effectiveness. We prefer to interpret the results as evidence of the complexity of the task involved in revealing such relationships, and of the need for hypotheses, controls, and tools adequate to this complexity.

For example, productivity choices received are probably highly related to activity level. Similarly, one might ask whether the effect of prestige based on the position in which one operated before coming to the Laboratory was adequately controlled in our investigation. Staton (8) has furnished evidence that the position an individual holds in out-of-discussion situations can affect the perceived value of the contributions he makes in the discussion situation. Although we assumed that the "cultural island" provided by the National Training Laboratory held such influences to a minimum, this may not have been the case (especially in the A groups); such influences due to extra-group prestige would of course becloud any relationships existing between our measures and the perceived effectiveness of the individual.

Again, although we assumed that the items on which individuals made their EGOT predictions were relevant to the day-by-day activities of the "T" and "A" groups, it is probable that this assumption was not equally warranted in all four groups. Those better able to predict others' reactions to items concerning matters which the group did not then consider important would be no more "productive" than those who were less able. It may have been necessary to determine more carefully which items did most definitely and presently concern the group.

Various impressions of differences in the way in which the various groups structured their activities—along with the fact that in one group (T_3) our measures of social perception consistently showed a positive relationship with measures of social effectiveness—suggest the importance of situational factors when considering such relatively straightforward relationships as we have hypothesized.

The importance of replication is also re-emphasized by our results. If we had by chance studied only T_3, we would have found relationships in the hypothesized direction. Our four-group replication provided a check on the generality of the hypothesized relationships, threw light on the need to consider the operation of other kinds of variables, and provided some clues as to what these other variables might be.

Thus the relation of accuracy of social perception, similarity, and perceived similarity to social effectiveness appears to be of greater complexity than our rather straightforward hypotheses can handle. Further investigation of situational factors and further refinements of our analysis are indicated.

REFERENCES

1. Chowdhry, Kamla, and Newcomb, T. M. "The relative abilities of

leaders and non-leaders to estimate opinions of their own groups", *J. abnorm. soc. Psychol.*, 1952, *47*, 51–57.

2. GAGE, N. L., and SUCI, G. "Social perception and teacher-pupil relationships", *J. educ. Psychol.*, 1951, *42*, 144–153.
3. HITES, R. W. and CAMPBELL, D. T. "A test of the ability of fraternity leaders to estimate group opinion", *J. soc. Psychol.*, 1950, *32*, 95–100.
4. JENNINGS, HELEN H. *Sociometry in group relations; a work guide for teachers.* Washington: American Council on Education, 1948.
5. NEWCOMB, T. M. *Social Psychology.* New York: Dryden Press, 1950; London: Tavistock Publications, 1951.
6. PEPINSKY, PAULINE N. "The meaning of 'validity' and 'reliability' as applied to sociometric tests", *Educ. psychol. Measmt.*, 1949, *9*, 39–51.
7. SPRUNGER, J. A. "Relationships of a Test of Ability to Estimate Group Opinion to other Variables." Unpublished master's thesis, Ohio State Univer., 1949.
8. STATON, T. F. "Relation of Selected Factors to Individual Prestige achieved in Seminars." George Peabody Coll. for Teachers, Contr. Educ., 1950, No. 423.
9. WOOD, H. G. "An Analysis of Social Sensitivity." Unpublished doctor's thesis, Yale Univer., 1948.
10. *Studies in naval leadership. Technical report, Project 268.* Personnel Res. Bd., Ohio State Univer., Columbus: Ohio State Univer. Research Foundation, 1949.

BIOGRAPHICAL NOTE

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BRIEFER STUDIES AND ANNOTATIONS

* * *

A PROJECTIVE METHOD FOR THE DIAGNOSIS OF GROUP PROPERTIES

MURRAY HORWITZ and DORWIN CARTWRIGHT

This paper describes an attempt to adapt a projective method, used in the diagnosis of personality, to the study of small groups. The investigation began with the following question: If properties of an individual are revealed in making up stories about TAT pictures (3), will properties of a group be revealed in stories which are made up by the group in the course of a group discussion? The present report deals with the administration and scoring of the test which was developed in exploring this question, and presents some of the preliminary findings. The data reported here—collected at the National Training Laboratory for Group Development—are based on the first five groups studied.[1] The results from this small sample are not intended as more than suggestive. They are presented here to illustrate the types of information the test may be expected to yield and to indicate the types of validation procedures we are employing.

The Ambiguous Group Structure Picture

Following a widely used criterion for the selection of TAT pictures we attempted to construct a picture in which group members could identify their own group as "the hero of the drama". To achieve ambiguity, characters in the picture were posed in contradictory attitudes as well as vague ones. The picture shows seven men grouped around a table. The individual at the head of the table may be seen as interested in the proceedings, the man to his left may be seen as bored. A pair in the foreground may be seen as showing friendliness, while an individual across the table is possibly hostile. The latter

1. Five training groups of from 12 to 15 members each were tested during 1947 session of the National Training Laboratory in Group Development, held at Bethel, Maine.

may be seen as sitting down or rising from the table, and a person near a blackboard may or may not be leaving the room. The subgroup formations were arranged to indicate the possibilities of cohesiveness versus group disintegration. In order that the picture could be simultaneously viewed by all members of the group to be tested, the photograph was enlarged to the size 2½ feet by 1½ feet.

Administration

The Ambiguous Group Structure picture was administered with modified TAT instructions as a test of group imagination. In the case of the Bethel groups the faculty leader was asked to leave the room to minimize inhibitions upon the members. The picture was propped up in clear view of the group members and the examiner read them the following instructions:

> "In the present situation we are going to see how well you can use your imagination. Here is a picture of a number of people in training at a workshop.[2] We would like the group to make up a dramatic story about what has happened before the scene which you see in the picture, what is going on at the present time, what the people are thinking and feeling, and finally what the outcome will be. This is a group project for which you will have twenty-five minutes. The story is not to be written out, but is to be developed by all of you as a group endeavor. Do you understand? We should like to have a dramatic story as to what happened before the scene you see in the picture, what is going on at the present time, what the people are thinking and feeling, and what the outcome will be."

The examiner then stepped aside. After twenty minutes he said: "That was very good. You have five minutes left. Would you care to summarize?"

The entire group discussion was electrically recorded.

Scoring

Rather than analyzing end-stories alone, as in the individual TAT, it was decided to score the full record of the group discussion. In the first place end-stories are, in practice, attempts by a single individual to summarize the group discussion. These summaries might be quite idiosyncratic. The second reason for using the full record is that, in a projective test of the group, information is obtained which is not so directly given in projective tests of the individual. In the individual TAT, the examiner must infer from the end-stories the covert tendencies in the mind of the subject which have produced this story. In a group discussion, however, more overt communication of members' thoughts and feelings is required. Thus the full record of the group discussion should reveal in a relatively direct way material which must be the object of inference in the individual TAT.

2. The phrase "in training at the workshop" was used only in the Bethel administration of the test, and has been omitted in working with other groups.

In order to quantify these qualitative records, the material is first divided into units. Every statement in the discussion, regardless of grammatical form, is broken down into as many distinct "protocol" sentences as possible. These are the simplest meaningful sentences, consisting of subject and predicate (or referent and characterization), which can be abstracted from a statement. Protocol sentences have the general form: X is doing ——; X is feeling ——; X is classified as ——; etc. The coding scheme is given in *Table I*. Only those protocol sentences are abstracted from a statement which can be formed by using the categories of *Table I* as subjects and predicates.

The subject of a protocol sentence may refer to a person behaving as an individual, a subgroup member, or a group member, or it may refer to the group as a whole, to a part of the group, or to some item in the environment (*Table IA*). The categories used for predicates were designed to correspond as far as possible with the variables used in group dynamics theory. It was hoped that by the use of such an *a priori* code, we might be able to link the test with theory, and thereby increase its diagnostic power. Predicates (or characterizations of the referents) are coded under one of the following conceptual headings: valence of members, valence of activities, valence of the group, acceptance or rejection of inductions, group structure. Two residual categories are employed—feelings not related to any of the preceding, and classifications of people or things in the picture (*Table IB*). In addition to statements interpreting the picture, the record of group discussions included statements dealing with operating procedures within the group while working on the assigned problem, as well as a variety of remarks not directly relevant to the task at hand. An empirical code was developed for these two types of material (*Table IC*).[3]

Interpretation

The data obtained consist of frequencies with which the content is coded under the various categories. To use these data in order to arrive at statements about the properties of the group being tested and about the relative strength of these properties, we make two general assumptions.

First we assume that the categories used in describing the pictured group reflect existing properties of the subject group, except for the properties "interpersonal hostility" and "group disruption", discussion of which seemed to be somewhat threatening in the group situation and to appear in disguised form. It is natural to ask why group properties should be reflected in this projective test, rather than personality properties of the individuals

3. It is obvious that a single statement may contain more than one protocol sentence. For example, the statement—"The man standing up to make a suggestion on how the group should work on the problem is being deliberately snubbed by the two across the table"—is translated into the following units: 1. Member is making a (rejected) induction. 2. The group is working on a task. 3. A subgroup is disliking another member. The number of protocol sentences obtained for the present set of five groups ranged from 175 to 427 sentences per group.

TABLE I *CODING SYSTEM FOR AMBIGUOUS GROUP STRUCTURE PICTURE*

A. Referents

Referent is:	*Code*
Person as individual	1
Person as group member	2
Group as a whole	3
Person as a subgroup member	4
Subgroup, clique	5
Some item in the environment	6

B. "Projective" characterizations

Characterization deals with:	*Code*
Interest (Valence of activity)	
1. Neutral interest; no indication whether interest is positive or negative	I
2. Positive interest; involvement; attractiveness of activity	I+
3. Lack of interest; unattractiveness of activity	I_1
4. Satiation; boredom; fatigue; former state of interest, now absent	I_s
Activity (Locomotion toward a goal)	
1. A goal directed act, success or failure not specified	A
2. Goal is (was, or will be) achieved	A+
3. Goal is not achieved; denial that act is goal-directed	A−
Influence (Exercise of social inductions within the group)	
1. Concern with inductions; no outcome indicated	P
2. Induction is attempted and *acceptance* of the induction is explicitly indicated	P+
3. Induction is attempted and is successful, acceptance is not explicitly indicated	P(+)
4. Induction is attempted and is rejected; also ineffective inductions or failure to make inductions	P−
Note: It has been found useful to distinguish here inductions by members and inductions by a leader.	
Liking (Valence of members)	
1. Concern with liking, no indication whether positive or negative; denial that interpersonal hostility exists	L
2. Characters are liking or are liked	L+
3. Characters are not liking or are not liked; rejection; aggression; unpleasant feelings having source in interpersonal relations	L−
Feelings (Expressions of affect, other than interpersonal)	
1. Affect discussed; no indication whether positive or negative	F
2. Positive affect	F+
3. Negative affect	F−
Group Characteristics	
1. Reference to group structure or process	G
2. Positive valence of group; locomotion towards group, etc.	G+
3. Negative valence of group; disruption of group	G−
4. Withdrawal from group without negative valence	G(−)
5. Reference to leader role	G_l
6. Reference to member role	G_m
7. Other role differentiations in the group	G_s

Classifications in the picture

1. Descriptive classifications (e.g., "person is at head of table")	C_d
2. Interpretative classifications (e.g., "person is a visiting scholar")	C

C. Procedure and non-story items

Procedural items

1. Proposing, assessing, or undertaking some group action	1–1
2. Expressed concern with defining the assigned task	1–2
3. Discussion of the temporal sequence to be used in constructing the story	1–3

Remarks about the test

1. Discussion of the photograph; of what's "really" there; of the purpose of the test; of policy in answering, etc.	2–1
2. Aggressive or disparaging remarks about the picture; complaining about or ridiculing the task	2–2

Reference to own experience (including the present situation of the group)

1. With respect to procedure	
a. Personal experience outside the subject group	3–a–1
b. Personal experience as a member of the subject group	3–a–2
c. Common experience shared as a group	3–a–3
d. Common experience, but not shared as a group	3–a–4
2. With respect to interpretation	
a. Personal experience outside the subject group	3–b–1
b. Personal experience as a member of the subject group	3–b–2
c. Common experience shared as a group	3–b–3
d. Common experience, but not shared as a group	3–b–4

Jokes; personal out-of-field remarks

Remarks about fellow members, friendly quality	4–1
Remarks about fellow members, aggressive quality	4–2
Matter of fact remarks	4–3

Explicit statements of agreement or disagreement with statements by other members

Agree with interpretative statement	5–1
Disagree with interpretative statement	5–2
Agree with procedural statement	5–3
Disagree with procedural statement	5–4

contributing to the story.[4] Experience with the test suggests three possible reasons: (*a*) tendencies for individual perception to be influenced by the group situation in which the test is being administered; (*b*) tendencies for an individual to report only those of his perceptions which are based on experiences shared with other members, and which are therefore likely to be accepted by them in the group discussion; (*c*) tendencies by other members to reject idiosyncratic material and to admit into the discussion only content which they too perceive, the "least common denominator" in this respect being content based on common experiences in the present group.

4. In an unpublished study the Ambiguous Group Structure picture was administered to individual subjects as part of the TAT series. Later the same picture was administered to the same subjects as a group test. No relationships could be discerned between the protocols of the two tests.

The second assumption relates to the strength of the group properties which are measured. We measure the strength of a given group property by the frequency of items in the corresponding category. In contrast to the individual TAT, where the subject may quickly develop a more or less general conception of the story he will tell, the groups we have tested tend to build stories in step-by-step fashion, with attempts made to reach agreement about parts of the story before new parts are suggested. This results in frequent summaries intended to ensure common understanding about points already agreed upon, so that as members continue to develop the story they are better able to make their contributions from common points of reference. The effect of this process is that interpretations which are accepted by the group tend to be more frequently repeated than interpretations which are not accepted.

Validation

We have attempted to validate the test by two procedures. First we examined other research data collected on the same groups for use as independent criteria of the properties supposedly measured by the present test, and compared the rank orders of the five groups according to criteria and test measures.[5] Since many of the variables measured by the test had no counterparts in independent measures of the groups, we approached validation from a second angle, namely, determining whether the *relationships* among group properties revealed by the test agreed with relationships predicted by theory. For this purpose we set out in advance a series of hypotheses stating expected relationships between pairs of test variables, whether measured in terms of projective material or in terms of the group's procedure in making up the story. To test agreement or disagreement with hypotheses, the rank order of the five groups on one variable was compared with their rank order on the second variable.

A large number of the rank order correlations obtained by both types of validation procedures were significant at or near the ·05 level.[6] In *Table II* the overall results of these validation tests are presented. Of the sixty tests which were run approximately one third (twenty-one) were significant at or near the ·05 level. Of the total of sixty correlations, fifty were in the predicted direction, seven were in the opposite direction and three were zero. It should be pointed out that in the course of developing the present scoring system, we gained experience with some, though not all, of our test and criterion measures. Although, as far as we are aware, the hypotheses tested were developed entirely on independent considerations, these theoretical

5. The "criteria" data used for the purpose were collected in a research program under the direction of J. R. P. French, Jr.

6. With only five groups, it is necessary to predict the direction of the correlation, and then to have correlations of ± 1·00 for the ·01 level, ± ·90 for the ·05 level, and ± ·80 for the ·07 level. The values are derived from Kendall (2).

predictions may have benefited—to some indeterminate degree—from information obtained from these earlier trial and error attempts.

On the basis of these results we attempted to "freeze" the interpretations, eliminating those which appeared to be clearly untenable, and using only those of the remainder which could be integrated into a coherent theoretical

TABLE II *CORRELATIONS OBTAINED IN TESTING THE VALIDITY OF INTERPRETATIONS OF TEST SCORES*

Rho	*Number of Validity Tests With Results in Expected Direction*	*With Results Opposite Expected Direction*
1·00	8	–
·90	9	–
·80	4	–
·70	13	1
·60	2	–
·50	6	–
·40	2	1
·30	–	2
·20	2	1
·10	4	2
·00	3	–
Total	53	7

scheme. This procedure left us with twenty-eight hypotheses, eighteen of which were supported at or near the ·05 level. Examples from this final group of hypotheses are presented below to illustrate the manner of interpreting the categories and the types of information which we suggest the test can yield.

AGREEMENT BETWEEN TEST MEASURES AND CRITERION MEASURES

Lack of Interest in the Group

Let us consider first the characterizations of the picture indicating lack of interest. These are interpreted as revealing more or less momentary absence of interest, applying to a single meeting, in contrast to longer-range fatigue or satiation. In order to compare the levels of lack of interest among the five groups, the frequency with which each group makes such characterizations is adjusted to the frequency of all characterizations made by the group. The five groups are thus ranked according to the score, "percentage of all characterizations that indicate lack of interest". $\frac{I_i}{C}$.

At the end of each meeting members rated their satisfaction with the

meeting on a five point scale, and the mean satisfaction ratings were computed for each group. We hypothesized that if projected lack of interest reflects the actual state of affairs in the group then there should be a negative relationship between rankings on this score and rankings on satisfaction with the meeting. The rank order correlation obtained confirms this hypothesis, *rho* = −1·00.

Exertion of Influence by the Leader

Characterizations indicating attempts to influence members, whether to have them set goals, to undertake particular acts, or to coordinate their activities, were tabulated. We then segregated all items in the story dealing with influence attempts by the leader, irrespective of the outcome of the attempt. To compare groups on the relative volume of inductions they attribute to the leader, we calculated the percentage of all characterizations that describe influence attempts by the leader.

At about the time the test was administered, a sociometric questionnaire was given in which members chose the most "productive" individuals in the workshop as a whole. Groups were ranked according to the percentage of members who rated their own faculty leader in first or second place on this productivity-sociometric. Assuming that the frequency of projections of leader influence attempts reflects members' perceptions of the level of activity of the leader in influencing the group, rankings on this test measure should be positively related to rankings on leader productivity. The obtained *rho* is +1·00.

Interpersonal Hostility in the Group

Items reporting perceptions of hostility seemed to be somewhat threatening in the group discussion. We assume that if hostility is perceived in the picture the subject may either report it directly, or attempt to disguise the perception by mentioning the topic of interpersonal liking but being noncommittal as to the quality of affect, L. An example of the latter response is "I wonder whether the individuals in the picture like one another." The category, L+, moreover, may indicate a genuine perception of interpersonal liking in the picture, but it sometimes appears to be used as though the individual wished to compensate for having reported an L− item, e.g., "I see lots of bad feeling in the group, but on the other hand some of the people do seem to like each other." If hostility is represented by [(L−) + (L)] and liking is represented by part of the (L+) responses, and if the tendency to use the remaining (L+) responses in a compensatory way is the same for all groups, then the excess of hostility over liking within a group is given by the score:

$$\frac{[(\mathrm{L}-) + (\mathrm{L})] - (\mathrm{L}+)}{\mathrm{C}}$$

A sociometric questionnaire was administered in which individuals indicated their preferred leisure-time companions among all people at the workshop. The degree to which a person liked his fellow group members was measured by taking the ratio of choices made within his own group to his total choices,

$$\frac{\text{Number of in-group leisure-time choices}}{\text{Number of total workshop leisure-time choices}}$$

The measure of internal liking within a group is the mean of these ratios for all members. As predicted, a negative relationship exists between the test measure of excess of hostility over liking and the sociometric measure of internal liking within a group, *rho* = −·90.

AGREEMENT OF RELATIONSHIPS BETWEEN MEASURED VARIABLES AND RELATIONSHIPS PREDICTED BY THEORY

Relationship between "Membership Orientation" and "Group Distractability"

"Membership orientation." This is defined in terms of the degree to which individuals move away from concerns about whether they like one another toward concerns about questions of inter-member influence. This distinction is based on the hypothesis that, where individuals first come together, personality characteristics are of major interest and interpersonal relationships tend to be viewed in terms of liking and disliking. As mutual expectations are established and the group becomes increasingly capable of developing group activities which require that members give attention to the coordination of effort, relationships come to be viewed in terms of reciprocal exertions of influence. The relative emphasis on "membership" versus "personality" orientations, thus defined, is measured by the ratio of projective items dealing with inductions to items dealing with liking, $\frac{\Sigma P}{\Sigma L}$.[7]

"Group distractability." The assigned task of the group in this situation is to create a story around the Ambiguous Group Structure picture. The group may " break out" of the instructions by talking *about* the picture (e.g., whether it is posed or genuine) or about the test situation (usually in a disparaging way). These remarks, produced as a by-product of making up the story, are coded 2–1 or 2–2, and are scored in relation to the total number of projective and non-projective items, N, produced by the group. Thus the score for "group distractability" or non-compliance with instructions is $\frac{\Sigma 2}{N}$.

7. When the test was administered at the beginning of the workshop ΣL items tended to exceed ΣP items, the median value of $\frac{\Sigma P}{\Sigma L}$ for the five groups being ·70; the reverse was true at the end of the workshop, the median value being 1·72.

As in clinical testing of the individual we interpret high level of non-compliance as indicating a lesser ability to attend to goals (4). Where concern over interpersonal liking or disliking is high (high ΣL) and the content of the story touches on these problems, the desire to avoid this threatening material may lead to more or less momentary abandonment of the task of making up a story. Where attention to problems of intermember coordination is low (low ΣP), failure to stick to the task may be brought about by conflicts of members pulling in different directions. These considerations suggest that group distractability, $\frac{\Sigma 2}{N}$, should be inversely related to degree of membership orientation, $\frac{\Sigma P}{\Sigma L}$. Confirmation of this hypothesis is obtained by comparing the rank orders of the groups on these two measures, *rho* = −·90.

Relationship between "Membership Orientation" and "Awareness of Group Structure"

"Membership orientation." We discussed the measurement of this property above.

"Awareness of group structure." Characterizations of the picture in terms of group process or group structure are coded under one of the "G" categories. Level of awareness of group structure is thus given by the score $\frac{\Sigma G}{C}$.

An implication of a higher degree of "membership orientation" is that there will be greater interdependence among members from the standpoint of relationships connected with group functioning. Thus in viewing the picture, the saliency of the group should increase for members in contrast to saliency of individuals. We hypothesize that the level of group awareness (operationally, seeing group process and structure in the picture) is directly related to level of membership orientation. A near-significant rank order correlation is obtained for groups ranked according to $\frac{\Sigma G}{C}$ scores and $\frac{\Sigma P}{\Sigma L}$ scores, *rho* = +·80.

Relationship between "Interpersonal Hostility" and "Group Non-defensiveness"

"Interpersonal hostility." The measurement of this variable in terms of the ratio, $\frac{[(L-) + (L)] - (L+)}{C}$, was discussed above.

"Group non-defensiveness." In making characterizations of the picture individuals frequently connect these characterizations with some experience of the group. Such references to the experience of the group or of the individual as a group member are coded 3-b-2, -3, or -4. Group non-defensive-

ness is operationally defined in terms of the ease of referring to these experiences in connection with making up the story, and is measured by the ratio,

$$\frac{(3\text{-}b\text{-}2) + (3\text{-}b\text{-}3) + (3\text{-}b\text{-}4)}{C}$$

The effect of interpersonal hostility in producing defensiveness was discussed above. If members of the group are sensitive on this score one means of avoiding these problems, while discussing the picture, is to minimize references to actual group experience. "Group non-defensiveness" or ease of referring to actual group experience is therefore hypothesized to be inversely related to the amount of interpersonal hostility projected. The rank order correlation based on the level of references to experience within the group and on level of hostility confirms this hypothesis, *rho* = −·90.

Relationship between "Interpersonal Hostility" and "Emotional Response to Inductions"

"Interpersonal hostility." We described this measure above.

"Emotional response to inductions." Where inductions are perceived in the picture and are explicitly described as being accepted or rejected, they are coded P+ and P− respectively. These are treated as "emotional" responses in contradistinction to the "matter-of-fact" responses, "P" (induction is attempted with no indication of its outcome) and "P(+)" (induction succeeds with no explicit indication of its acceptance). The tendency to respond emotionally to inductions is measured by the ratio of P+ and P− items to all inductions, ΣP, whether emotional or matter-of-fact.

$$\frac{(P+) + (P-)}{P}$$

We assume that the higher the level of hostility within the group, the less secure the individual will feel that others like him as a person, and the more likely he will be to make each attempted induction a test case of how well he is accepted personally. The expected consequence is that he should become particularly sensitive to the acceptance and rejection of inductions in the group, since these will be seen as providing evidence of personal acceptance or personal rejection. The hypothesis may be formulated as follows: the tendency to respond to social inductions with positive or negative emotionality is directly related to the amount of interpersonal hostility present in the group. Ranking the groups according to the test measures of "emotional response to inductions" and "interpersonal hostility", the obtained correlation confirms the hypothesis, *rho* = +1·00.

Relationship between "Group Productivity" and "Group Cohesiveness"

"Group productivity." The sociometric questionnaire in which members were asked to choose the most "productive" individuals at the workshop

was alluded to above. The ratio,

$$\frac{\text{Number of productivity choices made within own group}}{\text{Number of productivity choices made in the total workshop}}$$

was computed for each member, and the mean of these ratios was computed for all members in a given group. The groups could then be ranked according to how productive they were regarded by their members. Although this measure is derived from a source other than the present test, it is discussed as an example of validation procedure B since it is not used to test "face validity", but is hypothesized to have a "theoretical" relationship to the variable, group cohesiveness.

"Group cohesiveness." Group cohesiveness is used here in the sense employed by Festinger (1) to denote the resultant force acting on members to remain in the group. The attractiveness of the group, or the force toward remaining in it, is measured by the number of items coded G+. (E.g., "This looks like a good group." "This person is just coming into the group.") The forces away from the group are measured by the categories G−, consisting of statements suggesting group disruption, and G (−), consisting of statements that individuals are leaving. The resultant force to remain in the group is expressed by the measure:

$$\frac{(G+) - (G-) + (G(-)}{C}$$

We assume that unlike friendship groups, for example, the forces to remain in a Bethel training group or to leave it are based to a relatively small degree on feelings of liking or disliking individual members. The delegates at Bethel were in attendance to undergo a program of training and would be expected to desire the most effective training possible. Probably reinforcing this desire was the strong emphasis placed upon productivity during the 1947 sessions of the workshop. Thus forces into the group should be based on perceptions of the group's "productivity" and in particular, the training leaders "productivity". Forces away from the group might derive from the perception of an "unproductive" leader or "unproductive" members who interfere with the proper functioning of the group. The hypothesis tested is that the cohesiveness of this type of voluntary training group is directly related to perceptions of group productivity. Correlating rank orders of the groups on the measures of "cohesiveness" and "productivity", respectively, we obtain confirmation of this hypothesis, *rho* = +1·00.

In the validity tests presented above, examples of "face validity"—in terms of correspondence between the test measure of a variable and an independent measure of the same variable—have been presented for several variables. Examples of validity tests, based on the correspondence of relationships between pairs of measured variables and relationships predicted by theory, have also been presented for a number of variables. One may ask whether the variables which we have assumed to be independent are not

themselves related. In the limiting case, if all variables measured have either significant positive or significant negative correlations with each other they could not be said to denote distinct properties of a group but would appear to reflect some common underlying variable. Correlations between pairs of these presumably distinct variables were computed and found to be uniformly non-significant, except for a perfect positive correlation between "inductions by the leader", $\frac{P_1}{C}$, and "membership orientation", $\frac{\Sigma P}{\Sigma L}$. This correlation may be to some degree spurious since P_1 items are included in P, and L items are included in C. A possible alternative interpretation is that in groups whose training leaders make many attempts at influence $\left(\text{high } \frac{P_1}{C}\right)$, members tend to perceive their relationships in terms of mutual influence rather than in terms of interpersonal liking (resulting in high $\frac{\Sigma P.}{\Sigma L}$) In view of the absence of significant correlations among the remaining variables there is no reason to believe that these variables are not independent, i.e., represent distinct group properties.

The test scores which have been discussed were collected at the end of the Bethel workshop, after the groups had been meeting daily for three weeks. Over this period of time one could observe that marked differences, apparently stable in character, had developed among the five groups. This probably accounts for our rather surprising success in finding significant relationships among variables ordered on group differences although only five groups were studied. Consistent with this view is the fact that tests administered on the first day of the workshop, before stable group differences could have emerged, fail to reveal any of the relatively clear-cut relationships reported above.

SUMMARY AND CONCLUSION

The applicability of a modified TAT technique to the study of group properties was investigated. Group discussion of an ambiguous picture of a group was coded according to categories which correspond in part to constructs used in group dynamics theory. Strength of group properties was measured by the frequency with which content could be coded under the various categories.

Preliminary validation procedures were reported based on (*a*) the agreement of properties measured by the test with independent measures, e.g., sociometrics, rating scales, (*b*) the agreement of relationships between measured variables and relationships predicted by theory. Significant or near significant relations with validity criteria were found with respect to many of the test dimensions.

The findings are sufficiently encouraging, we believe, to warrant further exploration of the technique.

REFERENCES

1. FESTINGER, L. *et al. Theory and Experiment in Social Communication.* Ann Arbor, Michigan: Research Center for Group Dynamics, University of Michigan, 1950.
2. KENDALL, M. G. *The Advanced Theory of Statistics,* Vol. I. London: Charles Griffen, 1948.
3. MURRAY, H. A. *Thematic Apperception Test Manual.* Cambridge, Mass.: Harvard University Press, 1943.
4. RAPAPORT, D. *Diagnostic Psychological Testing,* Vol. II. Menninger Clinic Monograph Series, No. 4. Chicago: Year Book Publishers, 1946.

BIOGRAPHICAL NOTE

MURRAY HORWITZ took his undergraduate work at the College of the City of New York specializing in mathematical logic. During the war he worked in Methods Engineering with the General Motors Corporation, later serving in the Navy. In 1946, he resumed graduate study under Kurt Lewin at M.I.T. and was Assistant Study Director at the Research Center for Group Dynamics. Later he worked as Study Director at the Survey Research Center, University of Michigan, where he directed a survey on public attitudes toward mental health. Since receiving his Ph.D. in social psychology at the University of Michigan in 1950, he has been Assistant Professor in the Bureau of Educational Research, University of Illinois. He has engaged in training and research work at several sessions of the National Training Laboratory in Group Development. At present, under an Office of Naval Research grant, he is conducting research dealing with group effects on interpersonal hostility and motivational persistence.

DORWIN CARTWRIGHT is Professor of Psychology and Director of the Research Center for Group Dynamics, University of Michigan. A more detailed biographical note appeared in *Human Relations,* Vol. I, No. 4 (p. 553).

BOOK REVIEWS

Human Problems in Technological Change. Edward H. Spicer (Ed.), New York, The Russell Sage Foundation. pp. 301. $4.

This book contains fifteen case studies of problems encountered in attempts to introduce technological change in America, India, Peru, the Caroline Islands, and Canada. It is intended as a teaching text-book. The case studies and their analyses are contributed by fourteen contributors besides the editor. The presentation of each study follows the same pattern—a statement of the problem, a description of the course of events, the relevant factors in the situation, the outcome, and finally the analysis. At the end of each section on the relevant factors, the reader is invited to try to answer the questions raised and to forecast the outcome. Students are also recommended to make their own analyses before reading the one given. The book is presented in four parts. In each of the first three parts are five case studies; those in the first part fall under the general title of "The Discovery of Human Problems"; in the second under "The Analysis of Human Situations" and in the third under "Types of Human Problems". The three parts and the separate case studies in each part are arranged in ascending order of complexity. Twice in each part are brief suggestions for formal study. The fourth part briefly formulates some conceptual tools for solving human problems.

No claims are made for the correctness of the solutions reached and the contributions have been deliberately chosen to show both success and failure. The book "does not give rules for solving human problems. It is designed rather to open paths for finding them."

Both in the foreword by Mr. Leighton and in the introduction by the editor there is a condemnation of the use of sociological and psychological manipulation in the attempts to change people's way of life. Throughout the book, however, there was perhaps conveyed an impression that, provided the social scientist is ethically correct "whenever he seeks to alter people's way of life . . .", there is no need to inquire by whose ethical standards the correctness is being judged. It is difficult to believe that the editor or the contributors intended this impression and it is perhaps unfortunate that, if the ethics of inducing social change were to be discussed at all, they should have been discussed so briefly. If only because the possibility of the persistence of apparently outmoded custom as an attack on the reforming technologist or his sponsors does not sometimes appear to have been given sufficient consideration.

It will not be easy for many to accept the briefly stated argument "that people accept change is as valid a generalization as that people resist change". That "resistance is seen as a symptom of special conditions . . ." does not adequately justify the general hypothesis that when people participate in change, change will always be acceptable. Other recent work for example suggests that the maintenance of a "steady state" and an attempt to return to the "steady state" after disturbance may be a more general phenomenon. This does not exclude change, but it does condition its acceptance.

The case studies themselves are clearly stated and the relevant factors for the subsequent outcome and analysis are given. More sophisticated readers may sometimes wonder whether the statement either of the problem or of the outcome is as complete

as it sometimes appears, but each case is chosen to illustrate a particular point and does it well. Some of the reports of failure seem to be accounts of gross mishandling of the processes of change, but the fact remains that these are accounts of what actually happened and there is little doubt that similar events continue.

The analysis of some of the early cases, for example, that of the introduction of the wagon to the Papago Indians of South Arizona and that of the introduction of hybrid corn to Spanish American farmers in New Mexico, make their points concisely and clearly, while the analysis of others, such as that of the attempt to establish a stable water supply in Viru Valley of Peru, leave a feeling of incompleteness, due probably in part to their greater complexity, and in part to their appearance of having been written by someone who was not actively engaged in the attempt to bring about change.

Whether students agree with the solutions and analyses or not is less important than whether they will find the case studies sufficiently stimulating to make them work out solutions for themselves. This in all probability they will. The aim of the book is modest, "to provide a number of cases which may be used in a variety of ways for a variety of teaching purposes". The book fulfils this purpose admirably and is to be recommended.

A. K. Rice.

The Modern Family. Robert F. Winch. New York, Henry Holt & Co., 1952. pp. 522.

Since marriage and the family have become popular as subjects for university courses, the number of bulky, wordy and usually very dull general texts on the subject has increased alarmingly, but without shedding very much new light on the subject. Professor Winch has produced a book that is a marked improvement on most of those which this reviewer has seen in the past. In the first place it is unusually brief and this is achieved by the omission of words rather than of ideas. The book is written at an elementary level and is clearly intended for the beginner and the general reader and not for the serious student. At the same time it is accurate, thoughtful, and well documented.

Following some introductory remarks and definitions the reader is presented with a series of brief descriptions of family systems in other cultures—all drawn from well-known sociological and anthropological works. The economic, status-conferring, reproductive, socializing, and security-giving functions of the modern American family are each considered. Then follow a series of chapters on parent-child relationships at various stages in the life of the child, another series on courtship, love and marriage and finally a chapter on family disorganization. Both psychological and sociological factors are given due attention in a presentation that combines clarity of expression with respect for the complexity of the data.

Writing simply but accurately on complex matters is a difficult art, but one in which Professor Winch succeeds to an unusual degree. As might be expected, he is least successful in the two chapters dealing with infancy and the analysis of the nature of a love relationship. He has produced a book which even readers who are unfamiliar with social science are likely to find stimulating and convincing and which at the same time is unlikely to provide them with views which they will have to unlearn if they decide to pursue their studies further.

J. H. Robb.

The Social Welfare Forum, 1952. New York, published for the National Conference of Social Work by Columbia University Press. (London: Geoffrey Cumberlege). 32*s*. 6*d*.

This book, the official proceedings of the National Conference of Social Work, reveals the social workers of U.S.A. as keenly concerned with both politics and economics. The papers manifest a realistic insistence on the importance of a stable and expanding American economy as the basis for successful family living and reliable welfare services within the U.S.A., and for aid to poor and backward countries; this in turn aims at the establishment

of sound local economies to sustain a rising standard of living. There is also a courageous emphasis, in the face of powerful political pressures, on the need to correct inconsistencies between theory and practice, and between the domestic and overseas policies of U.S.A. Thus, one speaker points out that it is not possible to foster freedom of thought abroad while stifling it at home, and another that Asia is unlikely to look to U.S.A. for help towards realization of the Four Freedoms unless there is visible progress towards their realization within her own borders.

Two interesting papers illuminate in conjunction the curious intertwining of ideology and economics in the financing of social welfare. Donald S. Howard, of the University of California, is concerned to make a case for division of labour between public and private agencies according to an objective assessment of the needs of each area, and the quality of service which each type of agency can offer in that locality. In exploring the jungle of myth and prejudice which impedes so rational a solution, he mentions that it is not uncommon for private agencies to fortify their financial appeals with warnings that if they are not supported the government will have to take over the service. However, F. Emerson Andrews, of the Russell Sage Foundation, shows that a substantial proportion of the income of private social and welfare agencies is contributed by business corporations, and that well over half of this contribution represents in fact a subsidy from government, thinly disguised as remission of tax.

Such general topics rather overshadow the small number of papers on social case-work and social group-work, and these are concerned with policy rather than technique. Research projects in both fields are outlined, and further developments forecast. John E. Dula, of the Child Welfare League of America, makes a welcome statement of the case for integrating the existing specialized agencies for various types of child placement into comprehensive child welfare agencies, which could not only fit the type of placement to the needs of each child, but could also provide casework services designed to reduce the necessity of placement to the minimum.

Elizabeth E. Irvine.

Problems of the Family. Fowler V. Harper (Editor). Indianapolis, Bobbs-Merrill Co., Inc., 1952. pp. 806.

According to its editor this book is "an experiment in integration of the various disciplines which deal with problems of the family", notably law and the social sciences. Lawyers and social scientists would both gain, he considers, if each knew something of the other's field of study. One can heartily agree with this point of view while remaining doubtful if the aim has been achieved in this particular case.

The book consists of a mixture of legal reports and extracts from previously published books and articles. Apart from occasional brief interpolations explaining some point of law or other special problem, the cases and the extracts are left to tell their own story without any editorial assistance or interference. This treatment at once raises some difficulties. A consistent all-over view can be obtained only by dint of a great deal of hard work, which is rendered all the more difficult by the fact that to the vast majority of readers at least half the book deals with unfamiliar ideas presented in an unfamiliar way. This situation is not improved by the nature of the selections from the writings of the social scientists. They are drawn from a variety of different disciplines, based on differing theoretical approaches, and they vary from the highly technical to the extremely popular. On the whole the standard is low rather than high and there is heavy emphasis on impressionistic and descriptive works.

The choice of articles is in places difficult to understand. For example, the section on Patterns and Theories of Family Organization in Christian Cultures consists of an Encyclical Letter by Pope Pius XI and a chapter from *The Family* by Ernest R. Mowrer which, in so far as it deals with a religious point of view, refers only to seventeenth-century Puritanism.

The book is unsuitable for sustained reading, but more valuable as a source book. It is, however, difficult to use for this purpose as the table of contents, which lists only main headings is quite inadequate and the index little better. Furthermore, the main section headings are not always good guides to the location of the various articles and cases. The account of the law on birth control appears under the general heading of Sexual Maladjustment, while the section on Personality Conflicts covers social stratification in the southern states, reports on divorce cases involving cruelty, cases and articles relating to alcoholism, a note on the use of private detectives in divorce cases, a note on the Presumption of Legitimacy, and cases relating to divorce on grounds of insanity and crime, as well as articles on complementary neurotic relationships, the prediction of success in marriage, and finally, an article from *Atlantic Monthly* with the intriguing title "Do American Men Like Women?" All this without a single sub-heading, or reference in the table of contents.

There is a glossary of technical terms which reads rather like an old-fashioned dictionary as many of the definitions are so worded as to be either virtually meaningless, or understandable only by someone who is already familiar with the terms defined. "Psycho-analysis: the study of the instincts and their representations (behaviour) particularly the conscious and unconscious elements."

Understandably, the cases quoted are from United States courts (the House of Lords decision in Baxter *v.* Baxter is the only non-American case reported) and for most purposes this reduces the value of the book for the British reader, as well as involving him in the complications of variations in law from state to state.

All in all, a thoroughly irritating book, but not entirely without interest and value for those who are prepared to work hard while reading it.

J. H. Robb.

Apache Kinship Systems. Robert N. Bellah. Cambridge, Mass., Harvard University Press, 1952. pp. 135.

This short work is the Harvard Phi Beta Kappa Prize Essay for 1950. It comprises an analysis of different Apache kinship systems, demonstrating the interrelationship between social structure and kinship organization. This analysis will be of interest to anthropologists who are particularly concerned with the sociology of North American Indians, and Mr. Bellah makes some interesting comments on the theories of recognized authorities such as Murdoch and Ophr. However, this is a work of apprenticeship, founded on library rather than on field research, and in addition, it is too sketchy to count as a significant contribution to anthropology as a whole. Nevertheless, Mr. Bellah shows considerable power of lucid analysis and his future work will be anticipated with interest. Incidentally, this work demonstrates the difference in approach separating so much American from English anthropology. The first sentence reads, "In the first place, why study kinship?" There follows a well-argued apologia, but for years the study of kinship has been absolutely central to all anthropological research carried out by English investigators. To have to explain the reason for selecting kinship as a main topic underlines the difference between the more psychological approach of "cultural anthropology" in the new, and the sociological approach of "social anthropology" in the old world. It is to be hoped that the work of men like Talcott Parsons (to whom the author acknowledges his debt) and in time of Mr. Bellah himself, will do much to unite these two approaches.

A. C. T. W. Curle.

BOOKS RECEIVED

Owing to limitation of space the list of Books Received is held over till the next issue.

PSYCHIATRY

JOURNAL FOR THE STUDY OF INTERPERSONAL PROCESSES

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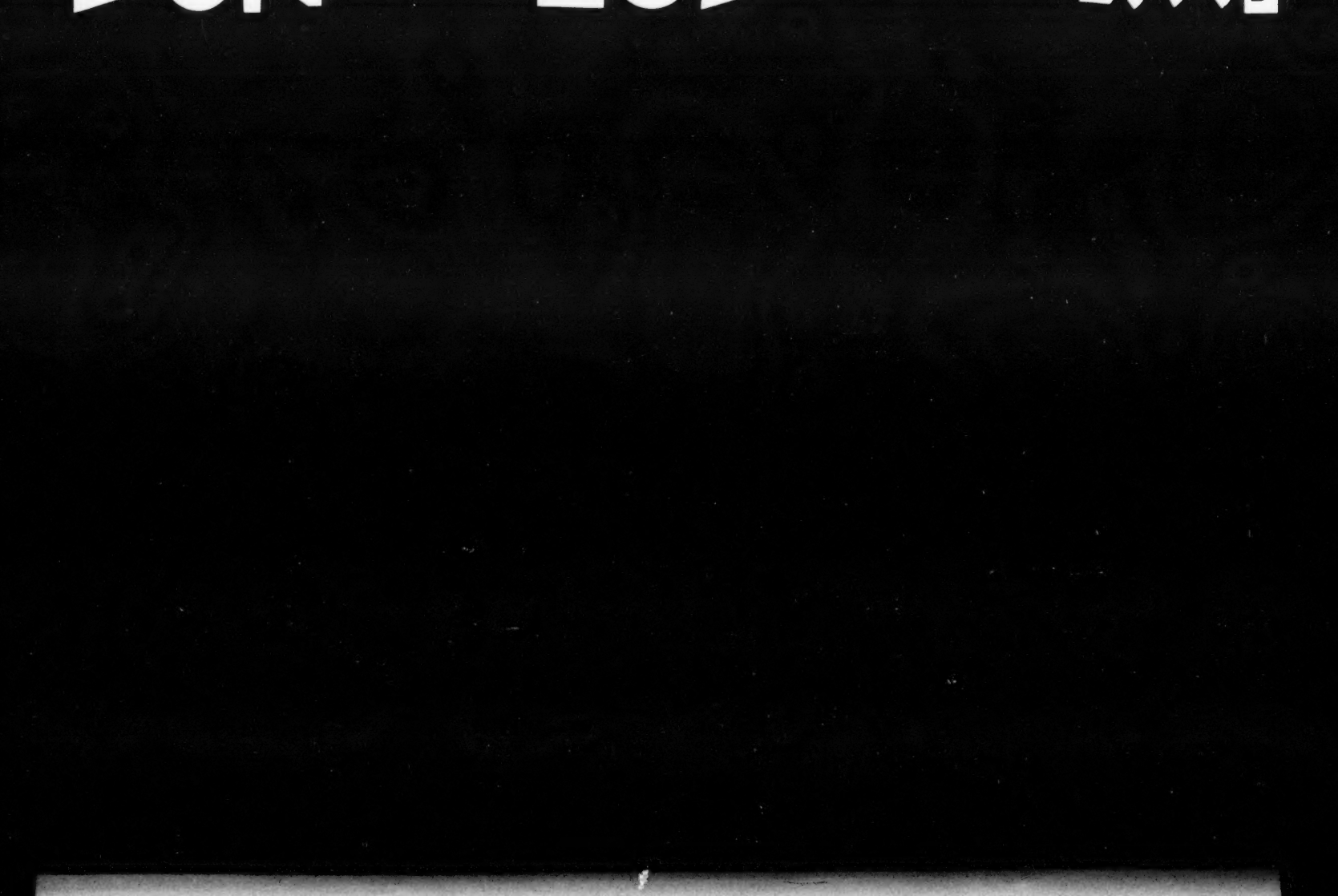
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